construction
engineering
research
laboratory

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

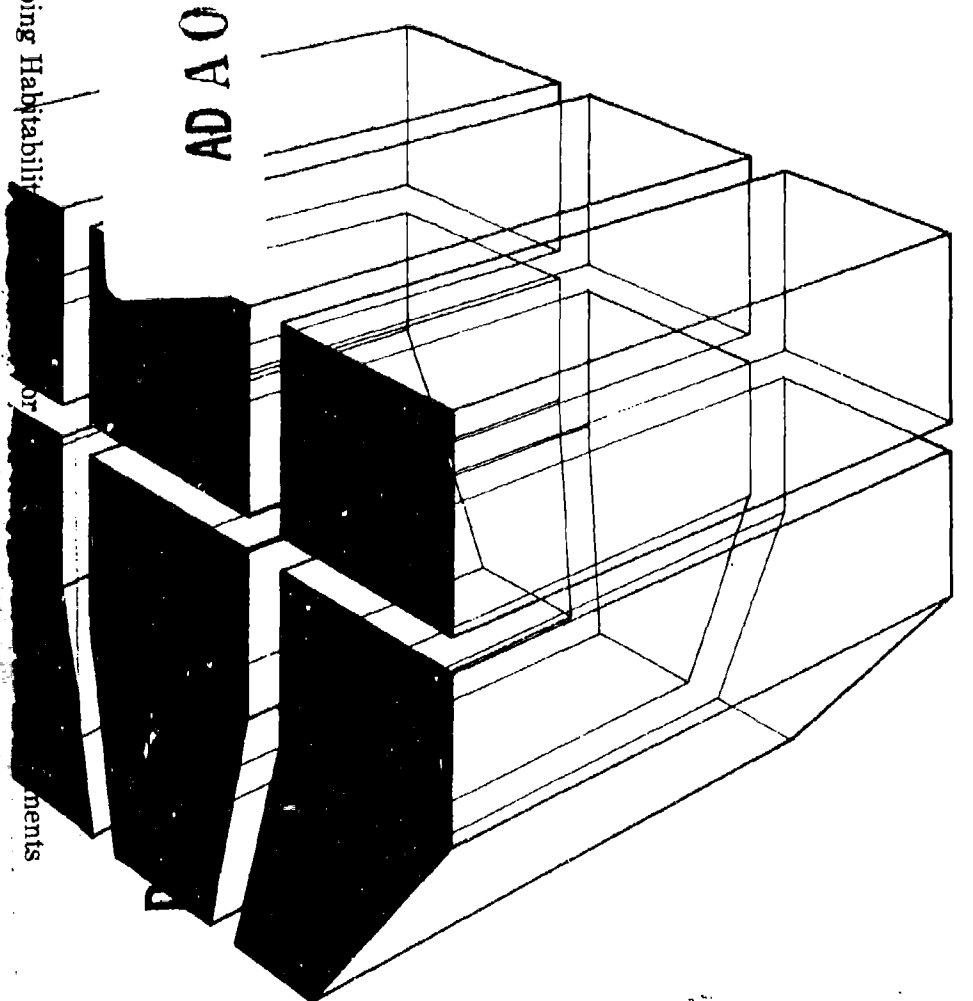
TECHNICAL REPORT E-142
July 1979

DEVELOPING HABITABILITY INFORMATION FOR THE DESIGN OF OFFICE ENVIRONMENTS

LEVEL II

by

Charles C. Lozar
Robert L. Porter



CERL

Approved for public release; distribution unlimited.

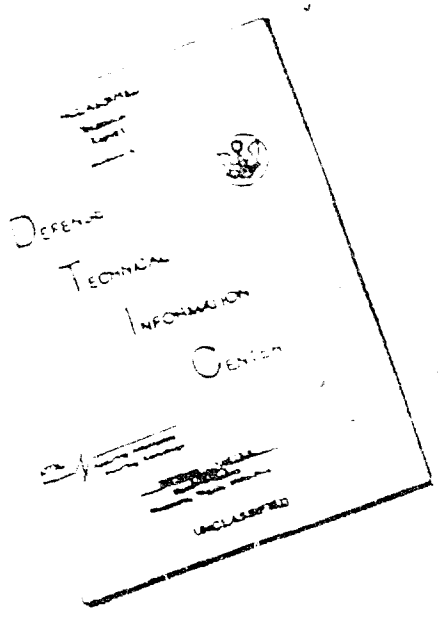
TR E-142

Developing Habitability

The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official indorsement or approval of the use of such commercial products. The findings of this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

DESTROY THIS REPORT WHEN IT IS NO LONGER NEEDED
DO NOT RETURN IT TO THE ORIGINATOR

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: CERL-TR-E-142
2. GOVT ACCESSION NO.:
3. RECIPIENT'S CATALOG NUMBER: Rept.

4. TITLE *(and Subtitle)*: DEVELOPING HABITABILITY INFORMATION FOR THE DESIGN OF OFFICE ENVIRONMENTS.

5. TYPE OF REPORT & PERIOD COVERED: FINAL Jun 76-Jul 77

6. PERFORMING ORG. REPORT NUMBER:

7. AUTHOR(s): Charles C. Lozar, Robert L. Porter

8. CONTRACT OR GRANT NUMBER(s): DOT-FA78NA-AP-8

9. PERFORMING ORGANIZATION NAME AND ADDRESS:
U.S. ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORY
P.O. Box 4005, Champaign, IL 61820

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS:

11. CONTROLLING OFFICE NAME AND ADDRESS:

12. REPORT DATE: July 1979

13. NUMBER OF PAGES: 153

14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*: 15 p.

15. SECURITY CLASS. *(of this report)*: Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service
Springfield, VA 22151

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

office buildings
architecture
National Aviation Facilities Experimental Center
habitability

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Habitability research deals with efforts to discover the impact of the environment on the behavior of the user/occupants in terms of their welfare, task performance, and satisfaction.

In administrative facilities such as offices, data from users can be used to discover factors of habitability, such as privacy, space, view, noise, or image. Information about these environment factors can then be applied to interior design solutions to

Block 20 continued.

improve the habitability for other office occupants. The methodology of this type of field research is to: (1) analyze results from before-and-after evaluations of renovations, and (2) use the analysis to generate design guidance for the layout and design of generic workstation configurations.

The approach to developing habitability factors for office occupants consisted of the design of a before-after experiment in which certain parameters of the environment (such as floor space, distance to next person, and degree of enclosure of the workstation) could be measured. An office staff of 130 persons at the National Aviation Facilities Experimental Center (NAFEC), Atlantic City, NJ, participated over a 1-year period in this evaluation. The initial comprehensive survey of occupant attitudes and behaviors indicated certain environmental conditions related to the habitability for the office occupants. New office layouts and workstation arrangements were designed and installed. The workstation components were designed so that a within-group experimental design for some parameters (high vs. low partitions, floor area variations, etc.) was possible.

After an occupancy period of 6 months in the new office environment, the users were again surveyed. Data analysis consisted of before-after comparisons of satisfaction with privacy, space, image, noise, etc., and the satisfaction with individual aspects of the workstation such as floor area, storage, work surface, etc. Factors of habitability (such as workstation image, privacy, and furniture satisfaction) were further analyzed with regressions and other analyses to indicate shifts in users' cognitive awareness of the environment in the before and after office conditions.

Interpretation of the research results yielded three kinds of applicable information: (1) understanding of office layouts and workstation evaluations for purposes of possible revision of the existing NAFEC design, (2) the possible development of generic guidance for office design relating to generalizable factors of habitability, and (3) development of quantitative methods of relating habitability factors to environmental components in terms of stimulus-response interactions.

FOREWORD

This research was conducted from June 1976 to July 1977 for the Federal Aviation Administration, National Aviation Facilities Experimental Center (NAFEC), Atlantic City, NJ. The project was funded through reimbursable order No. DOT-FA78NA-AP-8. The work was performed by the Energy and Habitability Division, (EH), U.S. Army Construction Engineering Research Laboratory (CERL), Champaign, IL. The CERL principal investigator was Dr. Charles C. Lozar.

Appreciation is expressed to Mr. Robert Faith, Director of NAFEC, for his foresight in recognizing the need for a study of this type and for his facility in accomplishing the project on schedule. Appreciation is also expressed to Mr. Frank Munroe and Mr. Tom Brennan of NAFEC for handling the detailed coordination necessary to make the project successful. Appreciation is also due Robert Neathammer, CERL Statistician, for his careful analysis of the statistical data and aid in interpreting results. Wayne Veneklasen assisted in on site data collection.

Mr. R. G. Donaghy is Chief of EH. COL J. E. Hays is Commander and Director of CERL, and Dr. L. R. Shaffer is Technical Director.

CONTENTS

DEVELOPING HABITABILITY INFORMATION FOR THE DESIGN OF OFFICE ENVIRONMENTS

1 INTRODUCTION

Background

Habitability research deals with efforts to discover the impact of the environment on the behavior of the user/occupants in terms of their welfare, task performance, and satisfaction.

In administrative facilities such as offices, data from users can be used to discover factors of habitability, such as privacy, space, adaptability, view, noise, or image. Information about these environmental factors can then be applied to interior design solutions in order to improve the habitability for other office occupants. The methodology of this type of field research is to: (1) analyze results from a before-and-after evaluation of renovations and (2) use the analyses to generate design guidance for the layout and design of generic workstation configurations.

There have been few instances in the literature of habitability or environmental psychology where this type of field research has been possible. It requires a stable field setting, a cooperative group of users, and a sponsor committed to the acquisition of new habitability knowledge in design.

The guidance developed from this study may have relevance to other office and administrative facilities, and aid in the improvement of habitability of these environments.

The fact that the research information had to be applicable to the construction of a new building made this study all the more unique.

This study was sponsored by the National Aviation Facilities Experimental Center (NAFEC), an agency of the Federal Aviation Administration. The building selected as the site for the experiment is a large airplane hangar with four floors of maintenance shops and offices. Only the second and third floors of the hangar building offices were involved in the office experiment.

Objective

The objective of this research was to develop guidance for the layout and design of a new office complex at NAFEC that will house most of the office and research functions currently located in separate buildings.

There were four main objectives in the development of this study:

1. The results should be developed as habitability guidance for the design of the layout and arrangement of office areas in the new building.

2. The results should enable an evaluation of present office planning criteria now documented in FAA publications on "Standards for Office Furniture and Equipment" (3 May 1972) and "Administrative Space Standards, Appendix 19." The review of the criteria set forth in these documents will then aid in future planning for office furnishings and space standards.

3. The methodology of this office experiment should be evaluated to aid in the development of further research dealing with the complex issues of office arrangement and planning.

4. The results should be analyzed and interpreted to generate generalizable habitability design guidance statements for generic office workstations.

Approach

An experimental design was created that would enable comparison of occupants' satisfaction before and after renovation. The procedure of the experimental design required arranging the research constraints necessary for the office experiment in collaboration with operating officials at NAFEC and in conjunction with their statements of organizational goals and objectives. Researchers also reviewed the organizational charts, staffing levels, organizational functions, interfaces of functions, and specific functional needs of each level of the organization occupying the second and third floors of the hangar building. Employees were surveyed to determine their specific functional needs, communication patterns, equipment requirements, evaluation of the existing facility, and perception of the organizational climate. Finally, special requirements of each organizational element and each individual workstation were evaluated against FAA design criteria and possible layout alternatives.

The following steps were executed to develop research controls for effective comparison of occupants' satisfaction before and after renovation.

1. First, an *orientation period* was used to translate the goals of the office management staff and employee satisfaction into operational objectives for the development of design guidance for the hangar building office area. This included an on-site inventory of existing facilities, resources, services, and space usages.

2. A *methodology* was developed for the before- and after-renovation evaluation of the office areas. This included the selection of pertinent variables relative to office area habitability, the design of questionnaires (Appendix A) and other instruments for data collection, and the evaluation of existing space allocation and space constraints.

3. *Data collection and analysis* involved in on-site execution of the methodology developed in step 2, followed by a statistical analysis of the collected data to determine the specific environmental relationships between a habitability issue, such as privacy, and a physical stimulus, such as office partitions.

4. A *design solution was developed* which translated the habitability relationships into specific planning statements for layout design. These specific design solutions were an attempt to optimize the satisfaction of the office occupants by improving the office arrangement in the hangar building. Alternatives of each prototype kind of workstation were also evaluated by office participants. Alternative layout designs based on an analysis of the environmental relationships data were reviewed by management and employees.

5. A *final design was developed* which met the needs of the office occupants and their management staff, as well as the need for CERL to have a controlled experiment in which a number of habitability issues could be evaluated in both the before and after condition.

6. The *experiment was implemented* through the purchase and installation of recommended materials and furnishings. This was done 3 months after the initiation of the study. Construction and installation took 7 weeks.

7. After *an occupancy period of 5 months* in the renovated offices, another survey was conducted using the same questionnaire. Respondents in the second survey were, for the most part, the same as in the first.

8. Finally, a statistical analysis of the before and after data was conducted to evaluate the specific physical components to determine which issues in terms of planning guidance, purchasing guidance, or design guidance would be of use for generic workstation designs.

2 DESIGN OF THE OFFICE EXPERIMENT AND INTERIOR LAYOUT

The objective of the first portion of work was to evaluate the existing employee satisfaction and functional needs and develop (1) an experimental design and (2) an interior layout design. Together, these designs would allow development of controls such that variables could be measured either within the groups in the before or after samples, or would allow a comparison of before renovation to after renovation across selected variables.

The Layout Design

The Office Setting

The setting for this experiment was the office area of the second and third floors of the hangar building at NAFEC. The building faces north, and most of the office areas have a view of the airfield through a full-length window wall.

The before-renovation office area consisted of 14,500 sq ft of space on the second and third floors. Offices were large open areas, with standard gray government office furnishings. The private office areas were for the most part semi-enclosed. The noise levels in the open area ranged from 68 to 85 dbA.

Besides the office, there were conference rooms, a technical library, a computer room, a snack bar, and a number of electronic laboratories. The general layout and configuration of the spaces can be seen in the architectural plans in Appendix B.

The office conditions in the existing setting were fairly representative of many government offices. The photographs in this report indicate that the layout of the office areas had developed haphazardly over a period of years and little thought had been given to the personal needs of the individuals at the work stations.

The plan in Appendix B indicates that the desks were located randomly and that there was no way to reduce noise, visual distractions, or foot traffic past individuals working in the open areas. It is also apparent that the management-level personnel had secured prime positions near the window walls. Other conditions in laboratory spaces and in the cafeteria are evident from the plans and photographs included herein.

Design of the Renovated Office Settings

There were a number of stages of the design process. The first stage consisted of a visit to the hangar building to sketch a series of alternative designs that were presented to individual members of each division on the second and third floors. After the sketch designs were reviewed and revised based on questionnaire responses by division personnel, more complete designs were created and submitted for final approval. When two iterations of these steps were completed for all of the divisions on the second and third floors, a final design was arrived at which attempted to satisfy the research requirements, individual desires, and physical functional requirements.

Participation

Previous work has shown that the degree of acceptability of a design proposal depends somewhat on the degree of involvement and participation the affected staff has in the initial design stages. Attempts were made from the beginning to involve the NAFEC staff in the planning procedures through discussions about the purpose of the questionnaire and how the results would be used in the final product. At the end of the initial design stage, the results of the questionnaire were visually presented to the staff. The rationale for changes which were going to be made was also discussed with office occupants. Individual staff members participated in the evaluation of the sketch proposals by identifying their objections to certain design elements.

Negotiation Procedures

In a project involving 111 people, it is obvious that not all elements of the building organization can be satisfied to the same degree. It should be noted in particular that in some areas experimental controls took precedence over user satisfaction. In these areas, there was a negotiated settlement whereby individuals agreed to try out certain types of furniture or arrangement for a trial period of 9 months. Although this procedure may bias some of the final responses in the evaluation, it was absolutely necessary since many of the major design issues touched upon by this work had never been evaluated in literature before. Nor was there a simple and conclusive way of setting up these issues as variables in laboratory settings.

Therefore, from the onset of the study, a series of interpersonal negotiations was required to meld the objectives for the research study with the human and physical needs of the users of the office environment. Negotiation in this instance implies a series of steps whereby the designer and the occupant together arrive at a layout and design for furnishings which will relate to the objectives of management, to users of the building, and to the needs for the research study.

Design of the Experiment

Office Demographics

The actual interior design of the office setting takes into account the functional needs of the 111 office occupants and the need for experimental controls before and after renovation. The distribution of the demographics of these individuals is of interest as a means of defining the group for generalizing data results.

Over 68 percent of the total office population consisted of engineers and technicians. The next largest group—10 percent—consisted of secretaries, clerks, and typists. The remaining individuals consisted of pilots, administrative management, security, and air controllers. Most of the population, consisting of the engineers, technicians, pilots, and secretary/typists, was located in the open office areas in the before condition. Only the executive management and division and branch chiefs, about 3 percent of the population, were in individual offices.

An analysis of the group indicated that the mean level of education was 14 years, suggesting at least 2 years of college. The distribution on this variable was quite wide, indicating a large number of individuals with professional degrees in engineering and science. This interpretation is supported by the fact that 3 percent of office occupants had master's degrees, 28 percent had bachelor's degrees and 10 percent had junior college degrees.

In terms of responsibility levels, 23 percent of office occupants were involved in some form of supervision and the largest group, 54 percent, was involved in support activity. Those individuals equivalent to principal or associate investigators on research projects made up 22 percent. Also, 33 percent of office occupants had some form of professional certification. The mean tenure at the Federal Aviation Administration was 12.18 years. However, this does not indicate necessarily that these individuals worked for NAFEC for that period of time. The mean pay grade was 10.7 on the Civil Service scale. All individuals in the office study had permanent appointments with the civil service commission.

It was determined that 95 percent of the participants in the after-renovation survey also answered the questionnaire before renovation, which indicated a 5 percent turnover in work force over the 9 months that the study was conducted. It is thus reasonable to assume a high degree of reliability in the before and after data, since the demographics of the sample population remained stable.

Experimental Control

It is difficult to control the physical stimulus in a working environment in which many individuals conduct their daily tasks. Therefore, experimental controls were developed through statement of design issued for environmental design guidance in the beginning of the study, and were then reviewed as the design procedure gradually took the form of the final renovation. The statistics reported here are only those for which there was adequate control in the before and after conditions.

The original layout design consisted of open planned offices and some interior private offices. When the original condition was evaluated using the survey, an analysis of the data indicated that the main problems were with noise, privacy, and general aesthetics of both the work station and the room. For the renovated design, changes were new partitions, a different layout, and removal of the circulation path from between the desks. The major colors were also changed and carpets installed.

It was these changes which, when implemented, resulted in improved ratings of major functional areas of the offices. But, more important, the design changes created the occupant subgroups needed to measure the variables of habitability.

3 DESIGN ISSUES RELATED TO THE PHYSICAL ENVIRONMENT OF OFFICE AREAS

Design information about desired environmental conditions can help insure more "responsive" facilities. There are various ways of describing how environmental design components may impact user/occupant activities, behavior, and experiences.

1. Ways the occupant *relies* upon the environment for instructions; i.e. stability, formality, clarity.

2. Ways the occupant has *control* over the components of the environment; i.e. privacy, choice, adaptability.

3. Ways the occupant uses the environment for *fulfillment*; i.e. social interaction, comfort.

4. Ways the occupant is *stimulated* by the environment; i.e. activity, efficiency.

5. Ways the occupant identifies with the environment; i.e. territoriality, image.

In reality the occupants of a space *are* also part of the environment—just as the furnishings and equipment are—except they are mobile, can be distracted, satisfied, and can cause extensive modifications in the physical environment. Also, occupants have the capacity to be aware of the total environment—how it enables or inhibits their purposes. In this context, a "habitable" environment allows the user/occupant to get beyond a routine, equipment-like condition, and into an alive, creative participation. Such an environment is considered "responsive" because the occupants feel supported in that their experience objectives appear to have an identity with their perception (or awareness) of the physical components of the spaces; i.e. they see their participation integrated into environmental components. The aim is to maximize (or at least optimize) the human potential involved through the process of an interactive integration of the user/occupants and supportive physical components of the environment.

A convenient way to view the comprehensive information necessary for architectural design is to ask two sets of questions:

1. What is needed? (requirements) and,

2. How are the requirements used (activities of the occupants)?

First, "what is needed" presents information about the *objects* of the future environment, such as desks, chairs, heat, light, etc. Second, "how are the requirements used" presents information about the *occupants* of the future environment, their activities, behaviors, experiences, such as the *privacy* for concentration at their desk, the *comfort* quality of their chair support, temperature range, and illumination quality. The combined information about the occupants' use of the objects is required for occupant-oriented architectural design solutions.

Habitability Design Information

All architectural projects are constructions of various spaces to be occupied and used by large numbers of people. The "habitability" of architectural spaces is the impact of the constructed environment on the various user/occupants. As such, habitability conditions can either enable or inhibit the user/occupants' desired experiences. Thus the desired experiences can be thought of as user requirements that need to be accommodated by a "responsive" physical environment—the more (or less) responsive, the more (or less) habitable. Habitability issues, as occupant/user requirements, can be categorized in three general areas:

1. Welfare issues
2. Task Performance issues, and
3. Satisfaction issues.

At a minimal level the user/occupant's physical welfare in terms of health and safety needs must be accommodated before task performance can be optimized. Similarly, task performance needs must be accommodated before individual occupant satisfactions can be recognized. For example, an office area *must* first have adequate illumination, temperature, and cleanliness. Next, it *should* have adequate occupant privacy, group size choice, and pleasant sounds.

The following is a relatively comprehensive list of specific user/occupant needs for each issue:

1. Optimum Occupant Welfare
    a. Optimal climate (air change, temperature, humidity)
    b. Avoidance of odor
    c. Avoidance of overtaxing eyes (glare, light-dark contrasts, light level and density tuned to functional requirements)
    d. Avoidance of noise disturbance from external and internal sources
    e. Acoustics according to functional requirements (reverberation, ambient, and transmitted sound, sound pressure, etc.)
    f. Avoidance of sources of danger (safety rules)
    g. Easy maintenance and cleaning of surfaces and building parts
    h. Consideration of cleanliness requirements of user groups
    i. Avoidance of emissions and polluting sources, control of sources of waste products, waste disposal

2. Optimum Task Performance (Function)

   a. Adequate amount of space area and volume

   b. Adequate amount of equipment and furnishings

   c. Ergonomic conditions and fit of equipment and furnishings

3. Optimum Occupant Satisfaction

   a. Sociable—enabling or inhibiting social interaction. Extent of elements that support the contact and the presences of several persons

   b. Privacy—sharing of the space based on visual, acoustical and physical relationships. Privacy is environmental control to minimize sharing

   c. Choice—degree of allowing co-existing behaviors. Accommodating extensive individual expressions

   d. Comfortable—degree of spacial, acoustical, and visual fit. Extent of emphasis on human requirements

   e. Clarity—degree space is identifiable in relation to its purpose. Extent of elements that have multiple meanings

   f. Efficiency—enabling or inhibiting direct circulation or simple operation. Degree of elements optimally use-resistant

   g. Adaptability—degree the space can be successfully modified. Extent of being responsive to new activities at nominal cost

   h. Formality—degree activities are structured by the space. Extent of elements that obviously prescribe behavioral rules

   i. Territorial—a personal relationship to the environment. Extent of elements allowing an identification with the space

   j. Activity—degree of lively or calm usage. Extent of elements encouraging dynamic activities

   k. Image—uniqueness of the character of the facility. Aesthetic expression of the functions of the facility and its parts

Nineteen specific design issues were investigated by creating sub-groups with differing physical components in the before and after office environments:

FUNCTIONAL ISSUES (Task Performance)

1. Number of occupants in a large room
2. Distance between office workstations
3. Storage adequacy at the workstation
4. Adequacy of lighting at the workstation
5. Conference room usage
6. Space and storage needs for laboratory work area

SATISFACTION ISSUES

Privacy

1. Components of privacy
2. Privacy related to proximity of circulation paths
3. The number of persons visible from the workstation
4. Partition height
5. Workstations for high-concentration tasks

Comfortable

1. Components of furnishing satisfaction
2. Components of furnishing comfort
3. The importance of an outside view

Adaptability

1. Flexibility of workstations

Territorial

1. Workstation personalization

Image

1. The "professional image" of a workstation
2. Aesthetics of the office area
3. Image of the building's exterior design

Designing Experimental Environments

The creation of a design setting involves a series of participatory steps by the office users and a series of negotiations of what might be best for the physical arrangement of furnishings and other decor within the office area. With this in mind, it is possible that the original design hypotheses as postulated by the designer can become somewhat diluted as one arrives at the final design solution. The result is that the hypotheses may no longer be statistically verifiable.

The implication here is that a tremendous amount of effort is required to create both the office design and the research experiment controlling certain variables. Initially, the designer and researcher have agreed on a set of issues they think will be beneficial to the development of guidance. However, as the plans suggested to the organization become reality, it becomes more and more difficult to retain the experimental control which will allow the statistical validation or rejection of particular issues. Therefore, although the designer may have started out with 50 issues for this particular design experiment, due to limitations of the experimental group, interactive effects which would confound the data, lack of reliability from samples which are much too small, and other experimental factors, the only issues reported here are those for which the researcher feels a great deal of confidence. This confidence is justified on the basis of adequate experimental controls, adequate size of sample, adequate distribution of statistics, and adequate independence of that particular physical component not confounded by other variables.

Evaluating the Before and After Environments

The issues investigated in this report generally deal with perception of a particular group of users and the relationship of that perception to some physical variable.

Two possible conditions allow this type of investigation. The first is an evaluation of user's perceptions before renovation. In this case, a possible example might be the distance of a user to a window wall. The before-renovation group of people makes up a total experimental group, and there is little need to relate to the after-renovation condition. However, after renovation, the addition of high and low partitions, for example, enables evaluation of changes in perception due to the differences among physical partition heights. Finally, since the experimental group consisted of approximately the same people before and after renovation, they represent the same sample; it is therefore possible to reliably compare the changes in perception with relationship to windows in the before conditions with no partitions, and in the after condition with low and high partitions.

Organizational Climate and Indirect Productivity Measures

Organizational climate is a measure of overall organizational health as perceived by managers, employees, and support staff. In other kinds of research, organizational climate has been used as an end in itself. That is, the social health of the organization has been measured with the intention of changing morale, procedures, or relationships between groups with the overall intent of improving productivity. One area of investigation neglected in much research literature is how organizational climate may, in fact, change when physical changes and improvements in the environment occur.

It would be reasonable to suppose that an improvement in the physical environment would change employee morale somewhat. Therefore, if one had a measure of overall organizational climate in the before-renovation condition, one would have a baseline measure of employees' perception of their organizational health. If one submitted the same questionnaire to the employees after renovation, the change in the physical environment may have caused a change in the social health of the organization. This improvement in organizational climate would obviously have some effect on employee productivity and satisfaction overall.

There are, however, two important cautions inherent in the above statement. The first is that of the Hawthorne effect. That is, any change in the physical environment which results in a change in employee satisfaction may be due to an employee's perception that management has finally shown interest in him/her, rather than due to actual physical stimulus changes. The second caution is that changes in organizational structure, personnel staffing, and employment opportunities during the time between the two surveys could color individuals' responses to their perception of organizational health. This factor is probably not much of a problem in this particular study since 95 percent of the original office users participated in the before and after evaluations and there were no organizational changes during the 9 months. It is therefore possible to look at changes in organizational climate in the before and after condition in this office study as an overall means of setting the stage for evaluating improvements in office areas and perceptions of individual office workers.

Results of the survey of organizational climate at NAFEC indicated no significant overall change between ratings of items before and after renovation for all respondents as a group. This result suggests that the change of physical interior office environment did not significantly affect organizational climate. However, as documented elsewhere in this report, individual survey items did shift towards more positive ratings for certain subgroups of office occupants. The implication is that, as a dependent measure for change in office environments, organizational climate is not as sensitive an indicator as the researchers had originally hoped for.

4 EVALUATION OF IMPROVEMENTS BY SPACE TYPE

The occupants' ratings of the space before and after renovation were evaluated. The basic assumption underlying these evaluations was that the improvements in various ratings would indicate the degree of "success" of the new design.

In some cases, these ratings may indicate the development of other design issues which could be used to develop habitability design guidance. For the most part they are presented as an indication that various physical components of the building have improved.

The ratings are presented here with the description of the area, a photograph of the area, and the scales in the before and after condition in which the area was measured. There then follows a short discussion and sometimes a conclusion drawn from the difference in ratings in the before and after condition.

It is not the intention of this section of the report to provide design guidance, but rather to indicate that (1) generally space ratings have improved and (2) some problem areas may still need fine tuning later on.

It should also be noted that this experiment was not intended to provide high satisfaction for all people in all areas for all environmental conditions. Rather it was desired to obtain an *optimum* level of satisfaction, i.e., approximately two-thirds of the user/occupants relating positively to a physical component.

Furniture and Workstations

There are six different types of office workstations in the before- and after-renovation condition at NAFEC. Analysis of the individual workstations was statistically impossible since the number of persons in a particular workstation might not be more than five to eight individuals. However, when the responses are combined, the overall profile gives some idea of the improvement in ratings for the workstation. The six types of workstations are:

1. *Administrative workstations*: These were usually the managers' offices, private or semi-private. Few were changed in the after-renovation condition, other than the painting of accent walls, and repainting and resurfacing of desks.

2. *Secretarial workstations*: Except for the executive secretaries in semi-private offices, secretaries were in open office areas before renovation, and all were adjacent to an open plan partition after renovation.

3. *Engineering team leaders' workstations*: These were workstations in open areas and usually had a table next to them so that the team leader could hold small conferences with his technical staff. After renovation, these workstations were more private because of the addition of partitions. Small conferences were moved to semi-enclosed conference areas nearby.

4. *Technical workstations*: These were areas occupied by the engineers working for the team leader, pilots, or other technicians. Before renovation, they were in open areas; after renovation, they had enclosure partitions.

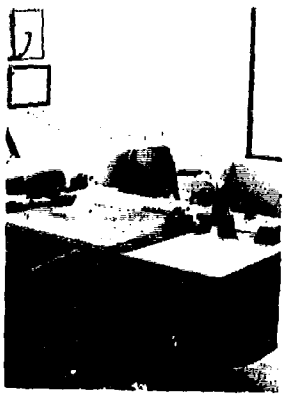
5. *Engineering drafting workstation*: This workstation was the same as the technical workstation, but with the addition of a large drafting table for each person and adjacent plan layout tables. Partitions were added.

6. *Laboratory workstations*: These were occupied by the technicians and usually consisted of a workbench and a desk. After renovation, partitions were added and workflow changed in some areas.

The survey was a three-section evaluation. The first section dealt with ratings of the furniture in the workstation, the second dealt with ratings of certain attributes of the workstation, and the last dealt with the components of privacy at the workstation. All respondents were grouped together for this analysis. The next pages contain photographs of the workstations before and after renovation, followed by the profile of the respondents' ratings and a summary discussion. This format is used for each of the functional areas evaluated.

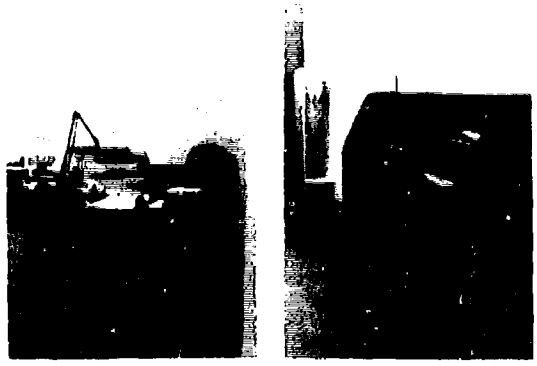
GENERAL ADMINISTRATIVE

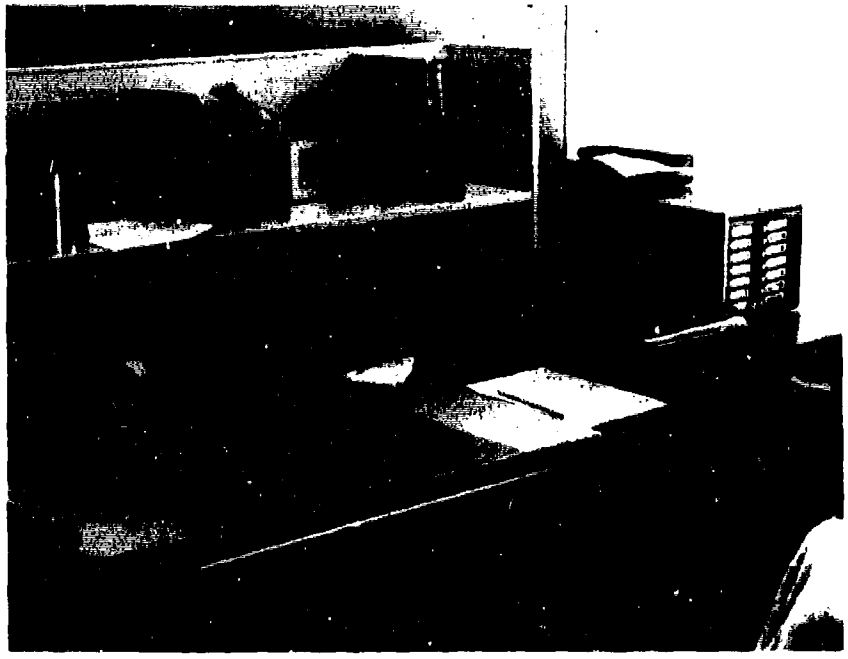
BEFORE



GENERAL ADMINISTRATIVE

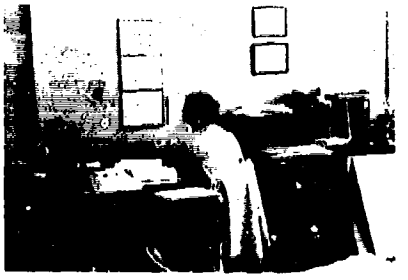
AFTER

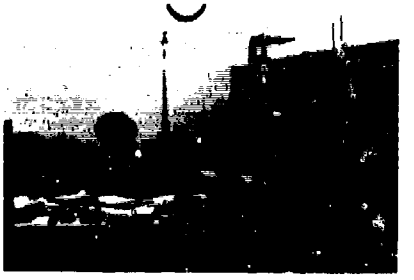




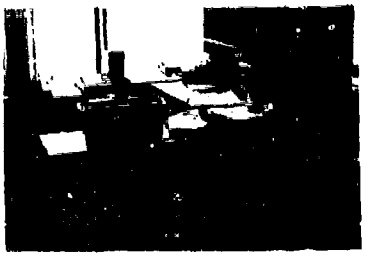
SECRETARY WORKSTATION

BEFORE



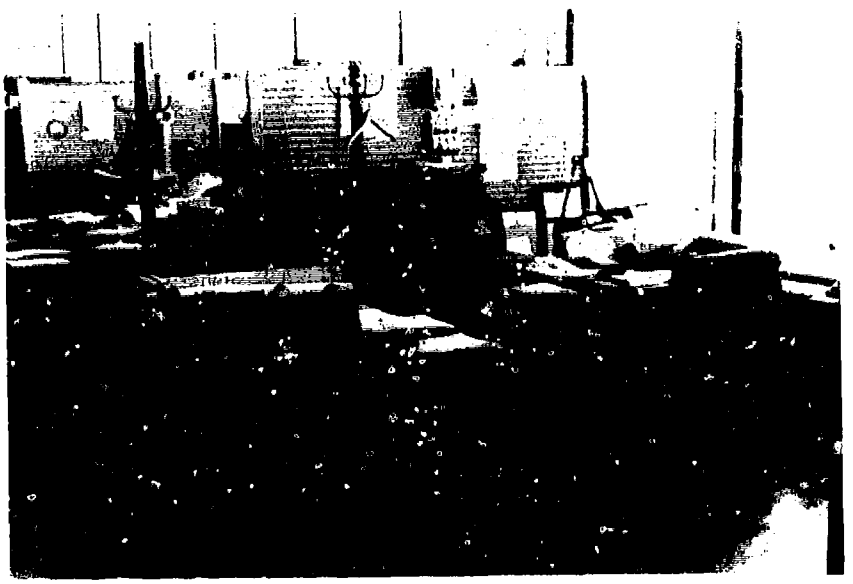


SECRETARY WORKSTATION
AFTER



ENGINEERING TEAM LEADER

BEFORE



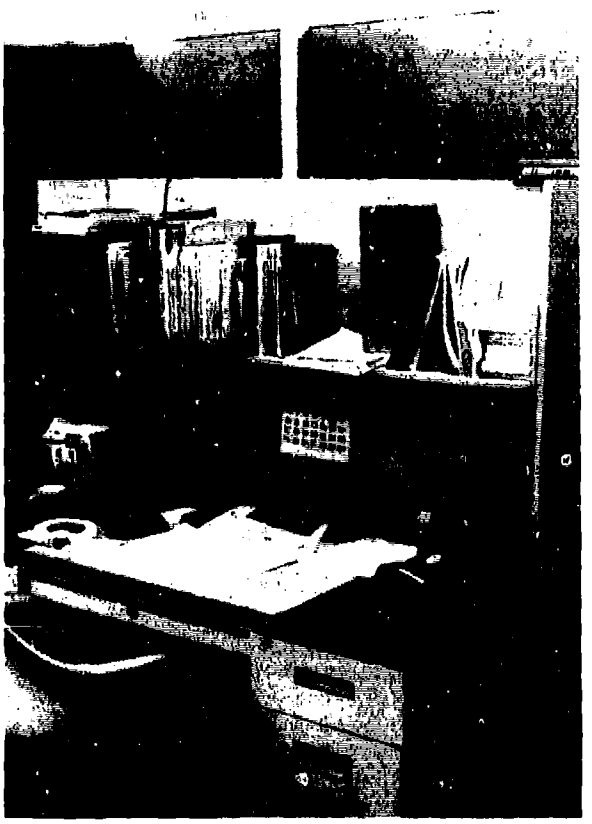
ENGINEERING TEAM LEADER

AFTER

TECHNICAL WORKSTATION

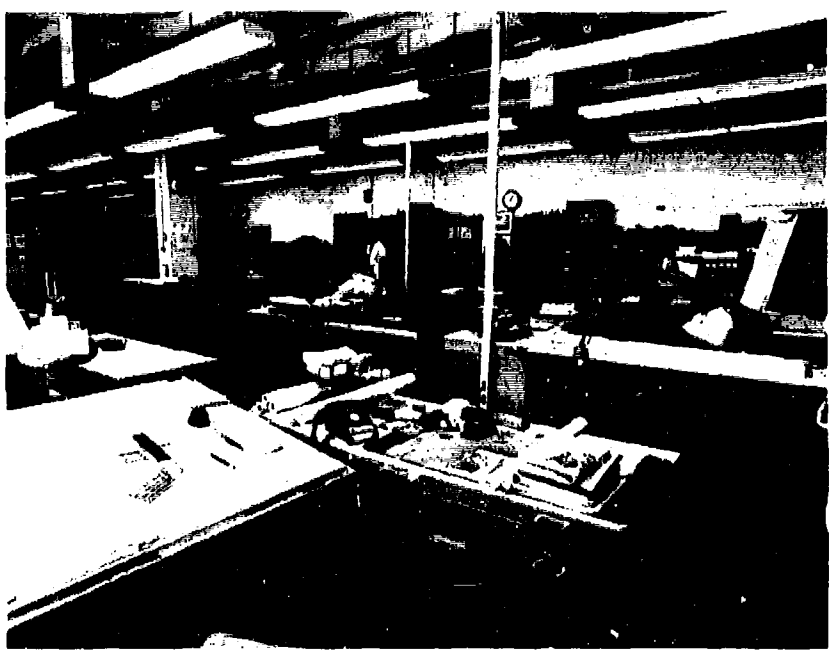
BEFORE

TECHNICAL WORKSTATION
AFTER



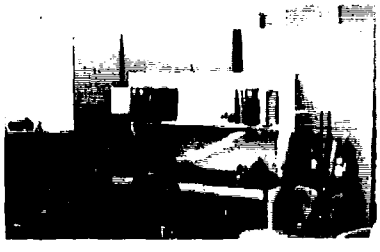
ENGINEERING DRAFTING

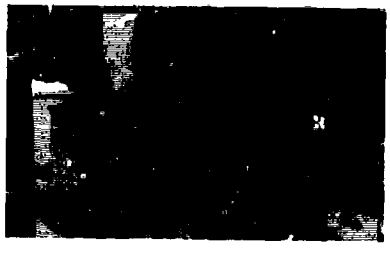
BEFORE



ENGINEERING DRAFTING

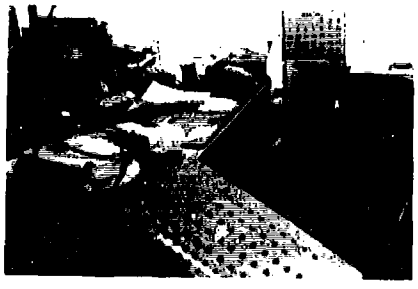
AFTER

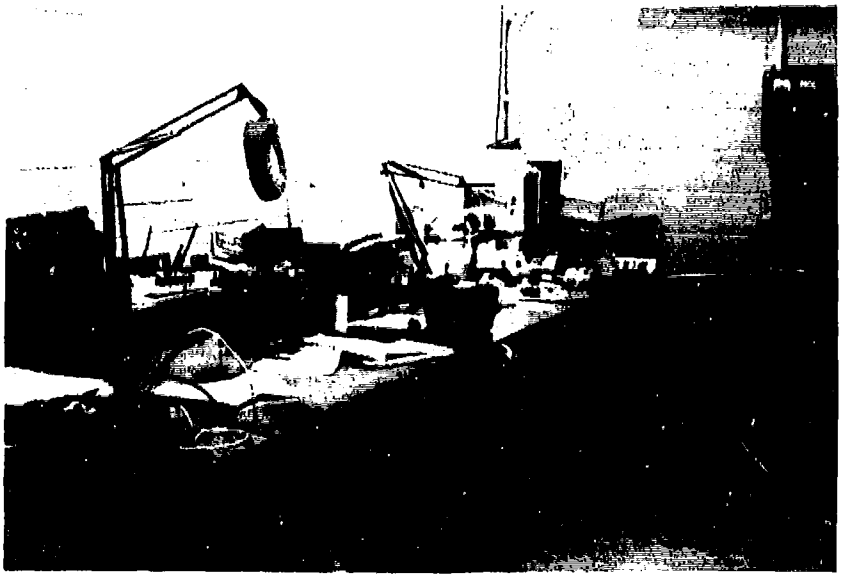




LABORATORY AREAS

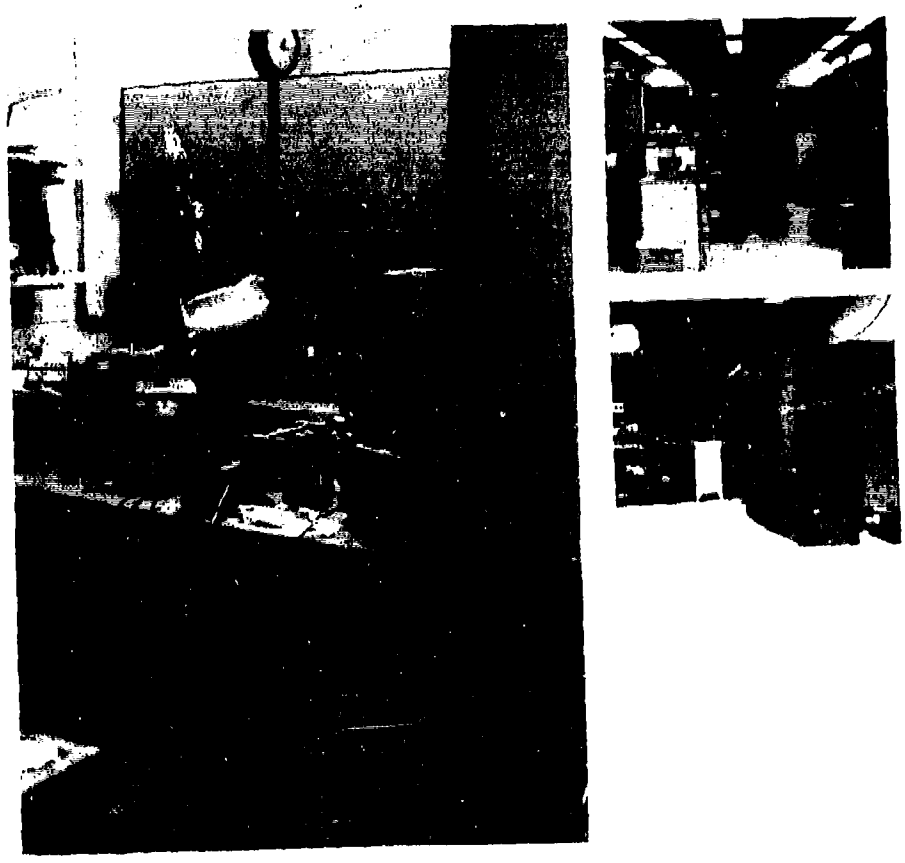
BEFORE





LABORATORY AREAS

AFTER



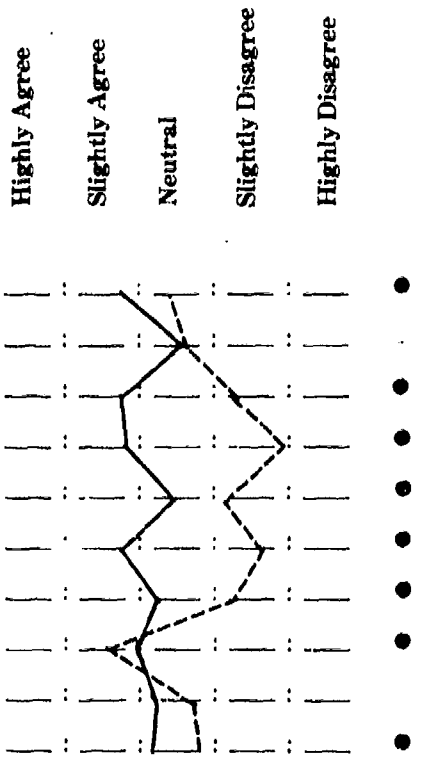
card 1
col. 1-3

FURNITURE

Quest. No. _____

The furniture you have in your work station can help or hinder your job effectiveness. The furniture consists of a number of individual items which you will be asked to evaluate as a group. Please indicate your agreement or disagreement with the following statements.

BEFORE RENOVATION ---------
AFTER RENOVATION ———
SIGNIFICANT DIFFERENCE ●



1. My furniture is **comfortable** ●
2. I have a wide **variety of furniture**
3. My furniture is **modern and stylish** ●
4. My furniture is **colorful** ●
5. My furniture is **easy to damage** ●
6. My furniture is **new** ●
7. I am **proud of my furniture** ●
8. My furniture is **sturdy** ●
9. My furniture is **high quality**
10. I am **satisfied** with the furniture in my work station ●

I have the following furniture in my work area (circle appropriate items)

11. **Desk** (14)
   1 Gray-green metal desk
   2 Wood desk
   3 Colored metal desk

12. **Bookcase** (15)
   1 Bookshelves
   2 Metal bookcase
   3 Wood bookcase

13. **File Cabinet** (16)
   1 2 drawer
   2 4 drawer
   3 Slide pullout
   4 Other

14. **Other Equipment** (17)
   1 Credenza
   2 Chairs
   3 Work Table
   4 Other

15. **Partitions** (18)
   1 Bank Screen (gray metal panels with translucent dividers)
   2 Landscape Office (interconnected panels with semi-private desk areas)
   3 Movable Freestanding (a few acoustic panels between desks)
   4 None (open office area with no partitions at all)

Furniture

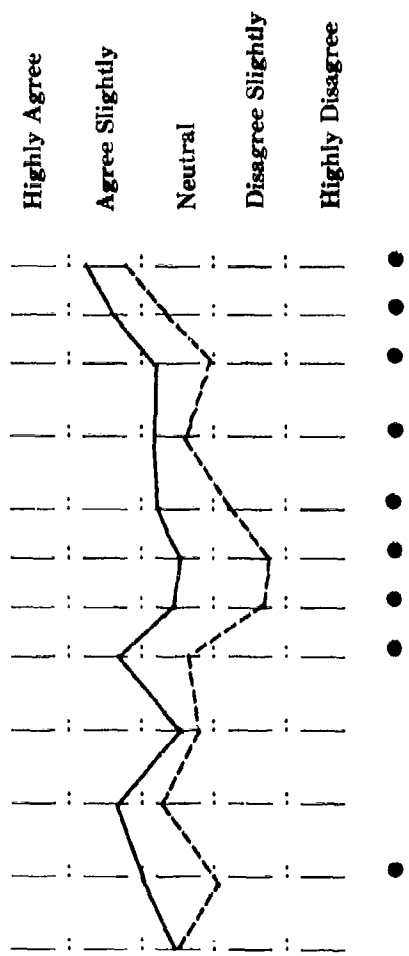
The responses of office occupants to the before and after conditions for their own office furniture show significant differences across many of the scales. The new furniture is rated as more comfortable, modern, colorful, newer, and of higher quality than the old furniture. Also, there is a significantly higher degree of satisfaction with furnishings in the work station. The data revealed that the sturdiness of the new furniture is rated significantly lower than the old; this corresponds directly with the low ratings of the new furniture's ease of damage.

The inclusion of new or repainted desks and bookcases and partitions, etc., has significantly improved overall satisfaction with furniture in the work station. The new office furniture from GSA's Office Excellence Catalog is perceived to be of lower quality and less sturdy than the older furniture. "Quality" implies better construction, and it is noted that the new furniture and the old furniture are not significantly improved ratings across most profile scales; some inherent qualities, such as sturdiness, ease of damage, and quality, make the new desks somewhat suspect for inclusion in the new office building.

WORK STATION

Your work station is the physical space in the room you and your office equipment occupy. Various aspects of your work station layout may affect your job performance. Please indicate the degree to which you agree or disagree with the following statements.

BEFORE RENOVATION ----------
AFTER RENOVATION ——————
SIGNIFICANT DIFFERENCE ●



16. The **size of my desk** surface is adequate for my tasks ●
17. The **area my space** occupies is adequate for my tasks ●
18. I have enough **storage space** in and around my desk ●
19. I find my **work station flexible** enough to meet changing requirements ●
20. I think my work station presents a **professional image** ●
21. The **privacy** I now have is adequate for my tasks ●
22. My **work station** is an **attractive arrangement** ●
23. My work station is easy to **keep clean** ●
24. I do bring items from home to **personalize** my work area
25. There are **no safety hazards** associated with my work station
26. I associate a **personal sense of pride** with my work station ●
27. Someone else has a work station I would prefer **rather than mine**

Work Station

The work station, which is defined as the physical setting around the occupant, consists of the attributes of the furniture and relates to how the attributes are used to support the job. In this profile for the before and after condition, most scales show a significant increase toward the positive rating. The size of desk surface, the area of space, the amount of storage space, flexibility, professional image, privacy, attractiveness, cleanliness, and personal sense of pride in work station have all significantly improved.

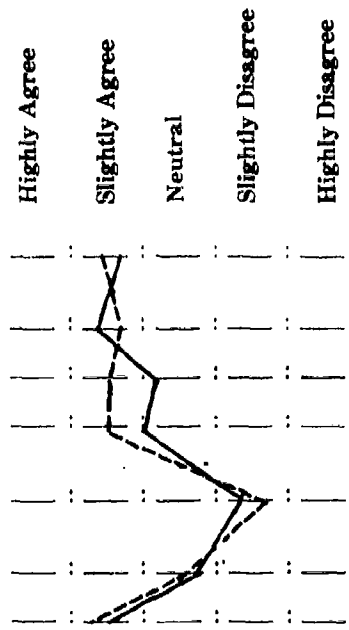
A further interpretation of these two profiles provides some insight into the stimulus effects upon the ratings. For example, the size of desks was not increased at all, yet is rated significantly better. There was not adequate storage space originally for many of the reference materials on the desks; a carrel unit on the desk surface provided an additional shelf for these materials.

The significant increase in space rating as adequate leads to an interesting interpretation. Overall there is less space around each individual at NAFEC than was previously available. However, occupants perceive that the area of their space is more adequate for their tasks. This implies that the increase in perceived space has been brought about by the more efficient use of actual space. There is a significant increase in terms of professional image, attractive arrangement, and personal pride in the individual workstation. These are all aesthetic factors connoting an improvement in overall aesthetics. There was no change in the rating of the question relating to someone else's workstation "I would prefer other than mine." This was expected since the workstations were similar to each other both before and after renovation.

PRIVACY IN WORK STATION

Privacy has many definitions, but seems to be a concept related to the nature of your tasks at your work station and in your room. Please indicate your degree of agreement with the following statements.

BEFORE RENOVATION ----------
AFTER RENOVATION ——————
SIGNIFICANT DIFFERENCE ●



88. **Conversations** in my room disturb my ability to concentrate ●
89. I can hear **noise** thru the walls of my office
90. **People** keep coming into my room and disturbing me ●
91. The **telephones** in my room are a noise irritant ●
92. I have a **high degree of control** over my privacy in my room
93. I have many **visual distractions** in my office which are disturbing
94. My **job** requires a high degree of **concentration**
95. Total number of people in my room is **(before = 20; after = 12)** ● 33
96. Number of people I can see while **sitting at my desk** is **(before = 13; after = 2)** ● 35

Privacy in the Work Station

Ratings of privacy at the work station are indicative of changes over the 9 months in which the experiment was conducted. To improve privacy, partitions, carpeting, and a hung ceiling were added and circulation paths rerouted. Responses to three of the questions suggest a significant difference in ratings for privacy in the before and after profiles: (1) conversations seem to have decreased as an irritating factor after renovation, (2) fewer people keep coming into rooms to disturb occupants, and (3) telephones are much less of a noise irritant.

The after condition has significantly reduced the mean number of people who are in the room from 20 to 12 and the number of people a person can see while sitting at his/her desk from 13 to 2. This has resulted in an overall improvement in major privacy components. In conclusion, one can say that privacy overall has been improved but some problems remain.

GENERAL OPEN OFFICE

BEFORE

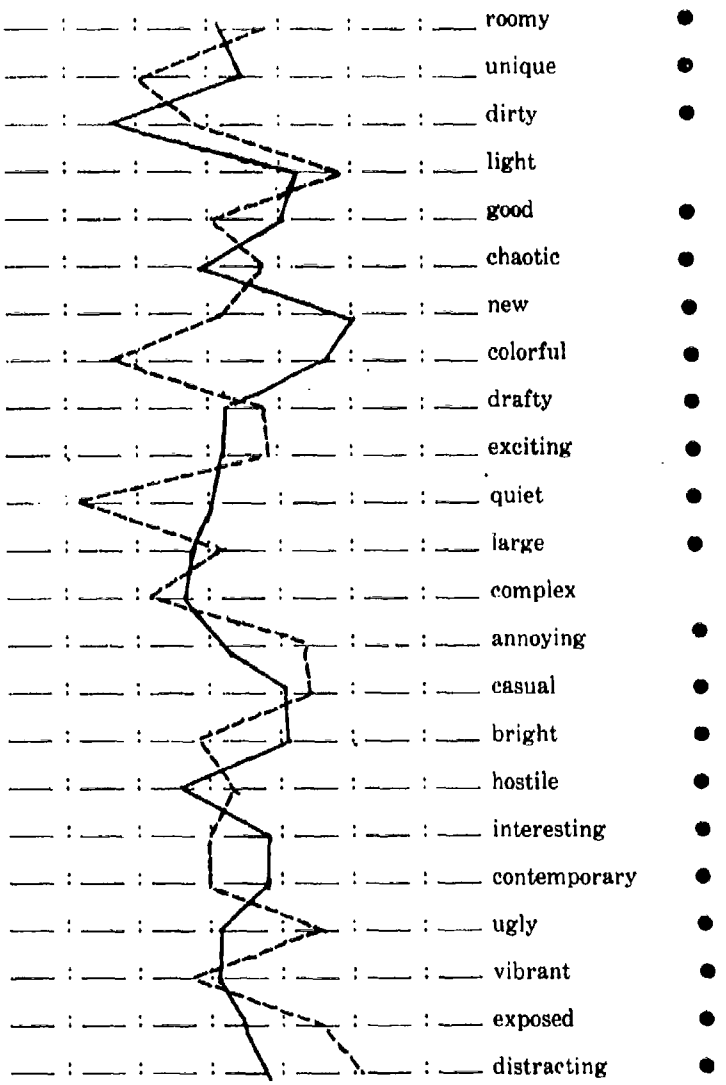
GENERAL OPEN OFFICE

AFTER

IMAGE OF WORK STATION AND ROOM

The work station you work with presents an image to you, your visitors, and other staff. Please indicate your rating of the image of your work station on the scales below by placing a check mark close to the adjective which best describes its attributes.

BEFORE RENOVATION - - - - - - - -
AFTER RENOVATION ————————
SIGNIFICANT DIFFERENCE ●

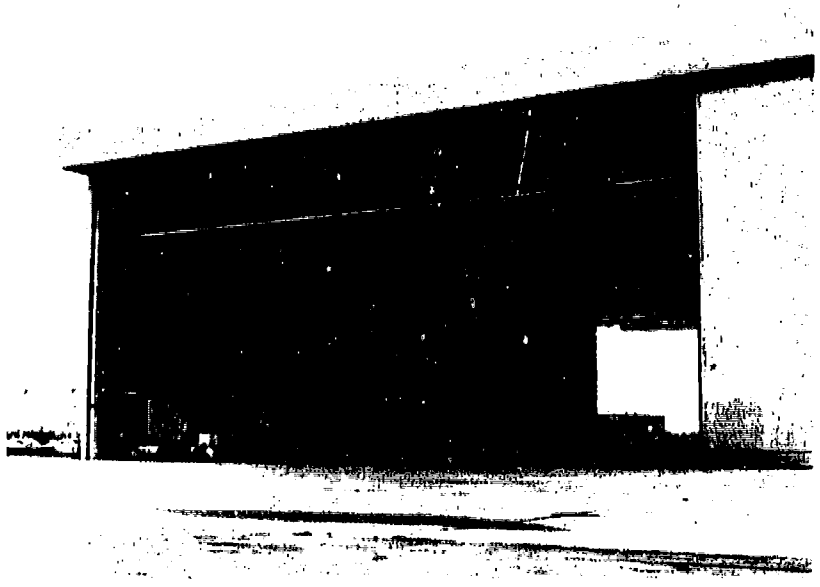


28.	cozy	roomy	●
29.	common	unique	●
30.	clean	dirty	●
31.	dark	light	
32.	bad	good	●
33.	ordered	chaotic	●
34.	old	new	●
35.	colorless	colorful	●
36.	stuffy	drafty	●
37.	calming	exciting	●
38.	noisy	quiet	●
39.	small	large	●
40.	simple	complex	
41.	pleasing	annoying	●
42.	formal	casual	●
43.	dull	bright	●
44.	friendly	hostile	●
45.	boring	interesting	●
46.	traditional	contemporary	●
47.	beautiful	ugly	●
48.	subdued	vibrant	●
49.	protected	exposed	●
50.	facilitating	distracting	●

Image of Work Station and Room

This group of semantic scales indicates overall changes in perception of the large room of work stations. Many scales show significantly better ratings after renovation. The new partitions cut out some of the daylight. There are, however, no significant differences between ratings of light or dark in the before and after conditions. One of the most dramatic rating increases is on the colorful scale. Another large increase is the change in perception of the overall rooms from noisy to quiet. Finally, the room is considered more facilitating and less distracting than previously.

BUILDING EXTERIOR



BUILDING EXTERIOR

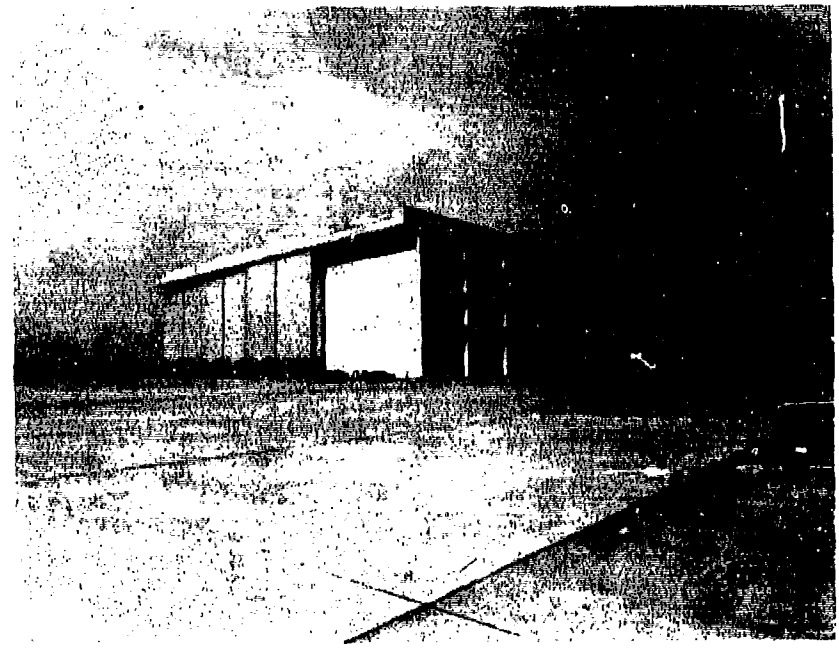
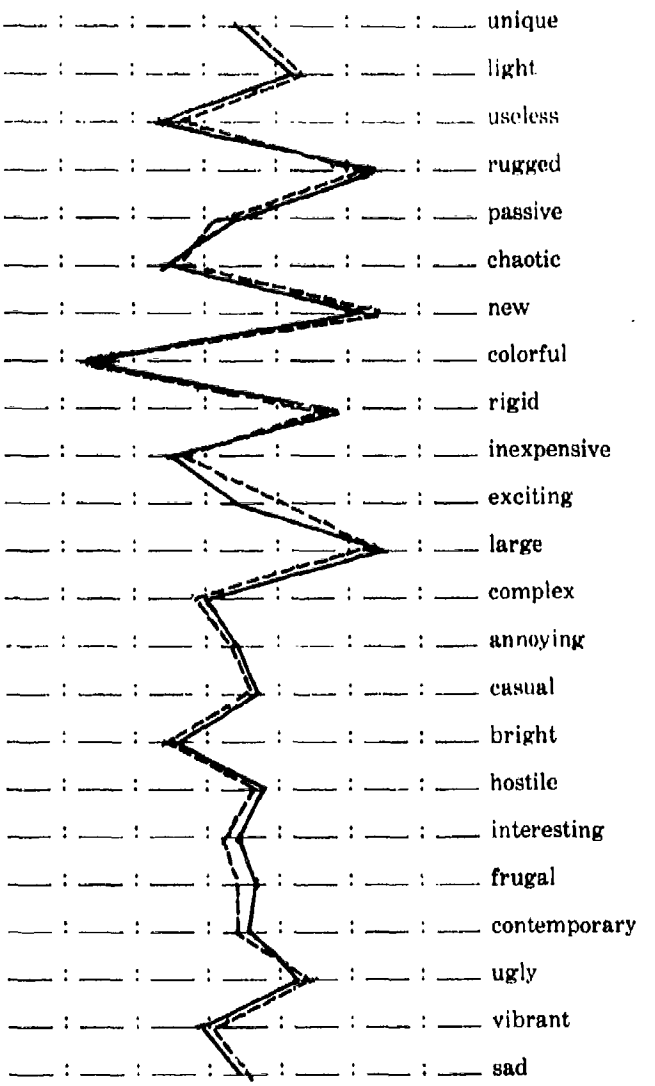


IMAGE OF THE BUILDING

The exterior of your building presents an image to the public, consultants, and new employees. Please indicate your rating of the exterior image of your building on the scales below by placing a check mark close to the adjective which best describes some attribute of the exterior. Rate all scales.

BEFORE RENOVATION ----------
AFTER RENOVATION ——————
SIGNIFICANT DIFFERENCE ●



102.	common	unique
103.	dark	light
104.	useful	useless
105.	delicate	rugged
106.	active	passive
107.	ordered	chaotic
108.	old	new
109.	colorless	colorful
110.	flexible	rigid
111.	expensive	inexpensive
112.	calming	exciting
113.	small	large
114.	simple	complex
115.	pleasing	annoying
116.	formal	casual
117.	dull	bright
118.	friendly	hostile
119.	boring	interesting
120.	generous	frugal
121.	traditional	contemporary
122.	beautiful	ugly
123.	subdued	vibrant
124.	cheerful	sad

Image of the Building

Over the 9 months during which the experiment was conducted, there were no physical changes to the exterior of the building. It is interesting to note that there are no significant changes in the before and after profiles across all of the scales for rating the image of the exterior of the building. This result is important for two reasons. First, it verifies the reliability of other measures. It indicates that the exterior of the building acted as a control in which, since nothing was done to it, the ratings on the scales remained very close to the original ratings. This suggests that the care and interest with which the respondents answered both questionnaires was very high. Second, this profile comparison indicates that a massive change of physical components on the interior of the building seems to have no effect on the perception of the exterior of the building. This implies that the ratings of the interior and the exterior of the building on semantic differential scales are totally independent of each other.

ROOM

Your work station is in a room. Certain attributes of this room can be rated individually and make up your total perception of your space in the room. Please answer the following questions.

BEFORE RENOVATION ----------
AFTER RENOVATION ——— ———
SIGNIFICANT DIFFERENCE ●

WINDOWS

51. How important is it for you to be able to see outside?

Extremely important ___ : ___B: ___A: ___ : ___ : ___ : Not important at all ●

52. Do you feel having a window is a factor in your ability to do your job?

1. Yes 2. No 55

53. Do you feel a window:

Improves my performance on the job ___ : ___B:A___ : ___ : ___ : ___ Distracts from my performance on the job

54. Can you see out any window from where you normally sit?

1. Yes 2. No (If no go on to 64) 57

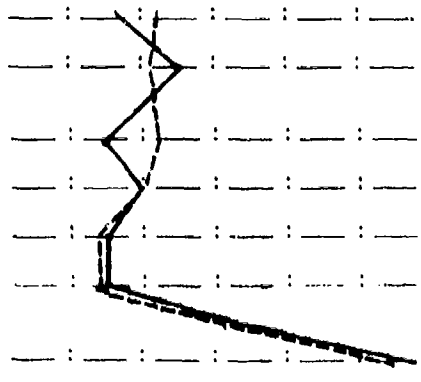
55. If so what can you see? (circle as many as necessary)

1. trees 2. cars 3. fields 4. buildings 5. supplies 6. trash 58 59

56. Which direction does your window face?

1. North 2. East 3. South 4. West 60

WINDOWS IN ROOM



57. Satisfactory ___ : ___ : ___ : ___ : ___ : ___ : ___ Unsatisfactory
58. Style attractive ___ : ___ : ___ : ___ : ___ : ___ : ___ Style unattractive
59. Provides adequate outside light ___ : ___ : ___ : ___ : ___ : ___ : ___ Provides inadequate outside light
60. Good location ___ : ___ : ___ : ___ : ___ : ___ : ___ Poor location
61. Good size ___ : ___ : ___ : ___ : ___ : ___ : ___ Poor size
62. Clean glass ___ : ___ : ___ : ___ : ___ : ___ : ___ Dirty glass
63. Easy to open or operate ___ : ___ : ___ : ___ : ___ : ___ : ___ Difficult to open or operate

Windows

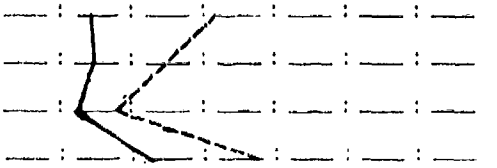
Office occupants' perception of the necessity of windows has been reduced in the after condition; that is, fewer people feel it is important to see outside after the renovation than before. Note also that there is no significant difference in the perception of a window improving or distracting from job performance in the before and after evaluation.

Finally, the semantic differential scales for ratings of windows in the room show no significant differences in the before and after conditions. This again verifies the reliability of the measures since, other than drapery, nothing was done to the windows during the 9 months. However, it should be noted that fewer people in the after condition can actually see outside because of the rearrangement of floor space and the inclusion of extra partitions in and around the desks. Therefore, the overall importance of being able to see outside significantly decreased even though fewer people could see outside. The relationship between job performance and seeing a window did not change significantly at all.

BEFORE RENOVATION ----------
AFTER RENOVATION ——————
SIGNIFICANT DIFFERENCE ●

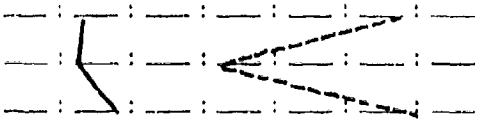
FLOORING IN ROOM

64. Satisfactory — Unsatisfactory ●
65. Clean — Dirty ●
66. In good repair — In poor repair ●
67. Attractive — Unattractive ●



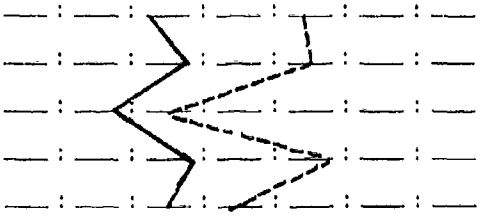
CEILING IN ROOM

68. Satisfactory — Unsatisfactory ●
69. In good repair — In poor repair ●
70. Attractive finish — Unattractive finish ●



WALLS IN ROOM

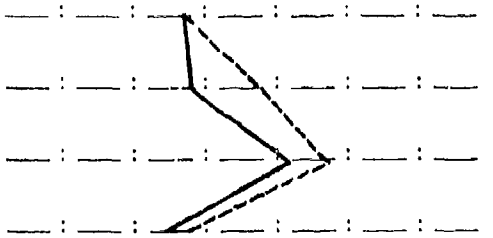
71. Satisfactory — Unsatisfactory ●
72. Easy to clean — Difficult to clean ●
73. In good repair — In poor repair ●
74. Attractive finish — Unattractive finish ●
75. Good quality paint — Poor quality paint ●



Dup 1-3

UTILITIES AND SERVICES IN ROOM

76. Lighting adequate — Lighting inadequate
77. Fixtures well located — Fixtures poorly located ●
78. Switches well located — Switches poorly located
79. Switches in good repair — Switches in poor repair



ELECTRICAL OUTLETS IN ROOM

80. Sufficient number — Insufficient number ●
81. Well located — Poorly located ●

AIR CONDITIONING AND HEATING IN ROOM

82. Air conditioning adequate — Air conditioning not adequate
83. Heating adequate — Heating inadequate
84. Easy to adjust — Hard to adjust
85. I am comfortable in most seasons — I am uncomfortable in most seasons

Flooring in the Room

Before renovation, the flooring in the room consisted of tile surfaces of a gray/green color. After renovation, earth-tone carpeting was installed. There were significant changes in the ratings of all four scales with the inclusion of carpeting.

Ceiling in the Room

Before renovation, the exposed concrete pan structure and mechanical equipment and wiring were visible to the office occupants. In the renovated office area, a hung ceiling was installed to hide much of the mechanical equipment and to add a better reflective quality to the ceiling. The ratings on all the scales dealing with ceiling improved significantly.

Walls in the Room

The walls in all of the rooms of the office areas, even the private offices, were painted with earth-tone colors. The five scales indicate significant improvement on every category for ratings of the office walls.

Utilities and Services in the Room

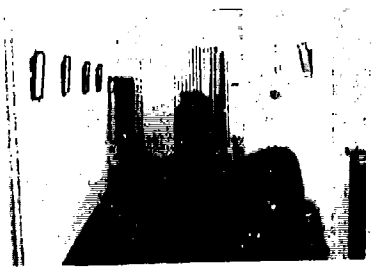
This is a combination of items dealing with lighting fixtures, switches, electrical, and air conditioning. For the most part, lighting and switches were not changed and little was done to the air conditioning equipment. These items show no significant changes. However, electrical outlets were changed so that easier access could be acquired to individual desks. These were changed from floor delivery outlets to ceiling power poles. Electrical outlets in number and location were rated significantly better after renovation.

HALLWAYS

BEFORE

HALLWAYS

AFTER

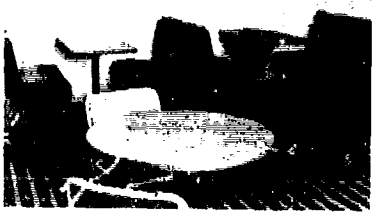


SNACK BAR

BEFORE

SNACK BAR

AFTER

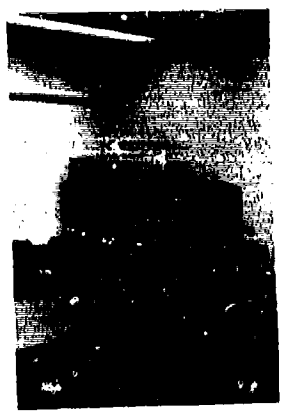


SMALL CONFERENCE
BEFORE

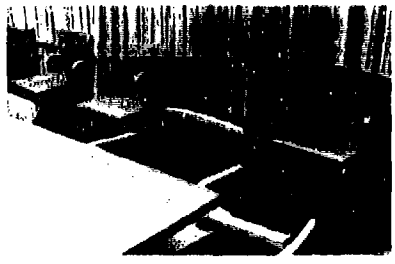
SMALL CONFERENCE
AFTER

LARGE CONFERENCE

BEFORE

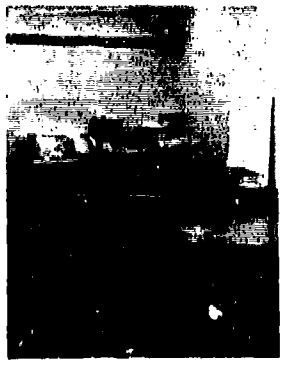


LARGE CONFERENCE
AFTER



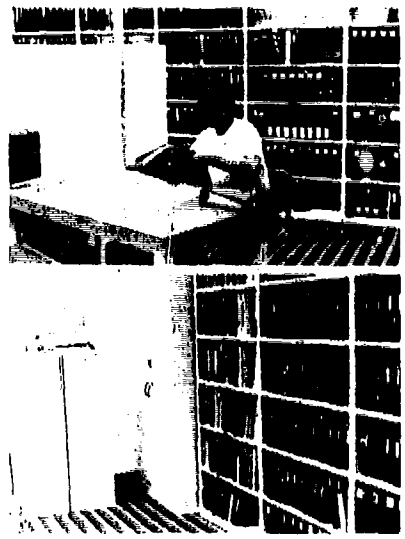
TECHNICAL LIBRARY

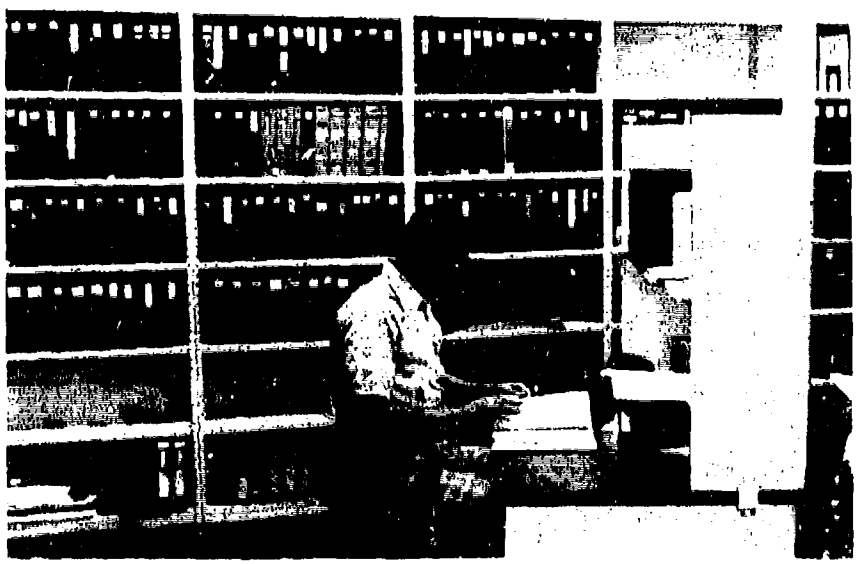
BEFORE



TECHNICAL LIBRARY

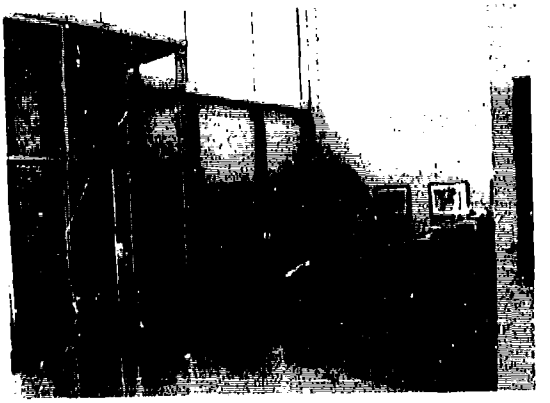
AFTER





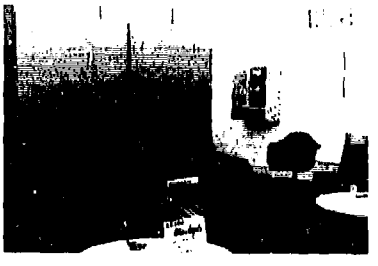
LOBBY

BEFORE



LOBBY

AFTER

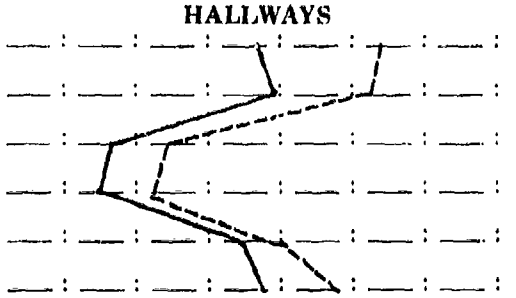


PARTS OF THE OFFICE ENVIRONMENT

A building is made of many parts such as halls, conference rooms, etc. Your ratings of these components will help in an overall evaluation of office space.

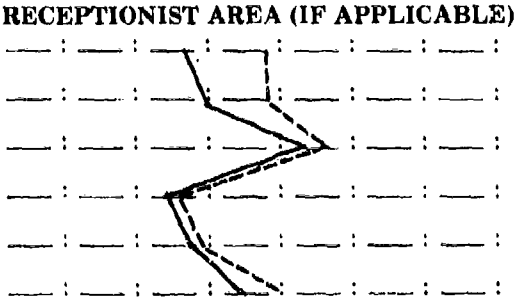
BEFORE RENOVATION----------
AFTER RENOVATION——————
SIGNIFICANT DIFFERENCE ●

HALLWAYS



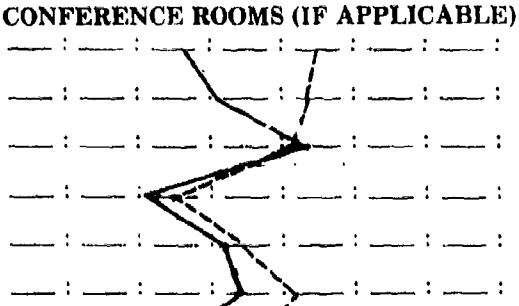
125. colorful	:	drab	
126. interesting	:	boring	●
127. dark	:	light	●
128. clean	:	dirty	●
129. friendly	:	hostile	●
130. beautiful	:	ugly	●

RECEPTIONIST AREA (IF APPLICABLE)



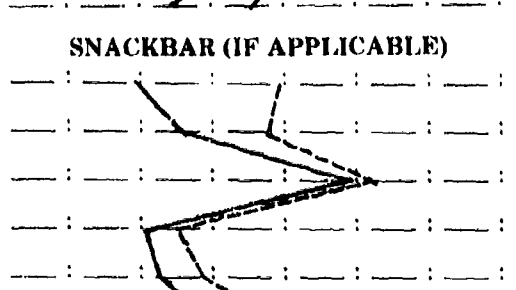
131. colorful	:	drab	●
132. interesting	:	boring	●
133. dark	:	light	
134. clean	:	dirty	
135. friendly	:	hostile	
136. beautiful	:	ugly	●

CONFERENCE ROOMS (IF APPLICABLE)



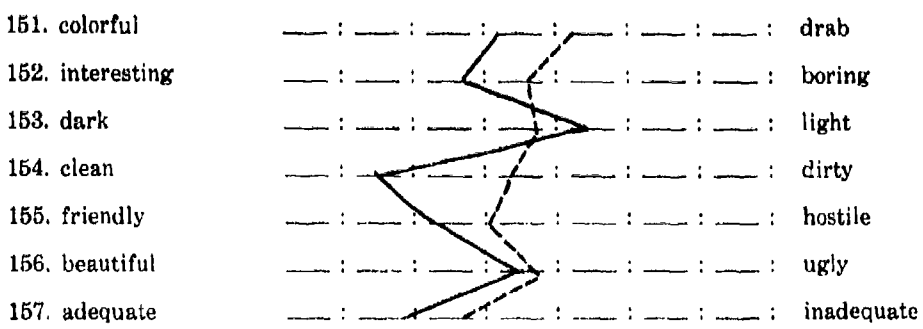
137. colorful	:	drab	●
138. interesting	:	boring	●
139. dark	:	light	
140. clean	:	dirty	
141. friendly	:	hostile	●
142. beautiful	:	ugly	●
143. adequate	:	inadequate	●

SNACKBAR (IF APPLICABLE)



144. colorful	:	drab	●
145. interesting	:	boring	●
146. dark	:	light	
147. clean	:	dirty	●
148. friendly	:	hostile	●
149. beautiful	:	ugly	●
150. adequate	:	inadequate	●

LIBRARY (IF APPLICABLE)



Hallways

The hallways at NAFEC were painted, and hung ceilings, carpeting, and new lighting were installed. All of the scales showed significant improvement, the hallways being rated more colorful, more interesting, cleaner, friendlier, and more beautiful. However, the hallways were also rated as darker because the average lighting level was reduced from 60 footcandles to 10 footcandles based on a GSA requirement to conserve energy.

Receptionist Area

The receptionist areas for each of the two floors were rated as significantly better in terms of being more colorful, interesting, and beautiful. The other scales were not affected by any changes in the receptionist areas.

Snack Bar

The snack bar was rated as more colorful, more interesting, cleaner, more friendly and beautiful, and significantly more adequate after renovation. The amount of light did not change in the snack bar area.

Conference Rooms

Conference rooms were rated as significantly more colorful, more interesting, more friendly, more beautiful, and more adequate in the after condition. Ratings of the lighting level and the cleanliness of the conference rooms did not change. The ratings on these scales are a composite of all of the small and large conference rooms in the before renovation condition. After renovation, large conference rooms and the smaller conference rooms in the open office areas contributed to the overall shift in ratings. However, because they were all measured as a group, one cannot statistically determine which conference rooms changed most.

Library

Across all scales there were no significant differences for ratings of the technical library in the hangar building. The changes made to the library consisted of painting the shelves, installing carpeting, and putting a new desk and shelving unit in. The overall physical changes in the library, although mostly aesthetic, were not extensive enough to prompt a significant change in attitudes.

5 DEVELOPMENT OF HABITABILITY INFORMATION

Interpreting Ratings of Improvements

The previous discussion indicated that most of the physical components of the offices had improved after renovation. However, these ratings of individual perceptions were composites of both the demographics of the entire group and the various workstation areas they occupied. To determine if substantial change was perceived within subgroups of the office population, further analysis was required.

The two most important subgroups to be identified were those individuals in enclosed offices and those in the open office areas. The two most important overall issues necessary to understanding the nature of differences in improvements for these two groups were: (1) *general acceptance of the new workstations* (open or enclosed), and (2) *general privacy at the workstation* (open or enclosed). The degree to which each of these subgroups exhibited a shift in response over a selected number of aspects or questions was taken as an indication of the success of the overall physical and functional renovation for each group.

First, respondents who participated in both surveys were identified. Then, respondents assigned to totally enclosed offices and those assigned to the multiperson open office area were separated. The responses of these two groups were then statistically analyzed for significant differences across the selected questions before and after renovation. Finally, the two major issues of acceptability and privacy were plotted (Figures 1 and 2).

Inspection of these graphic representations of results reveals that the staff members having enclosed, single person, office-type workstations had a more "positive" evaluation of their total workstation and the adequacy of privacy than those at the open-area stations. It is interesting to note that the response of those in the open area to their "after" workstation environment was nearly identical to the "before" response for those in the enclosed offices.

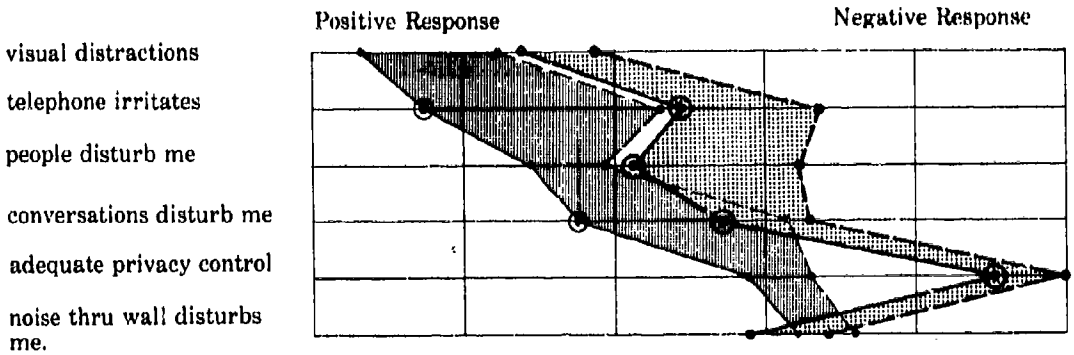
Interpretation of this positive shift in ratings suggests two possible conclusions. The first is that the changes in the physical setting in the open areas are perceived to have improved the quality of that environment to nearly that of the rated quality of private offices in the before renovation condition. The second conclusion is that the overall ratings of the open areas are still far from satisfactory on some issues such as control of privacy. Therefore, although conditions have improved a great deal, there is still a definite need for careful reevaluation of several issues such as privacy in the open, multiperson office areas.

Design Guidance

The ultimate purpose of this study was to present design information relevant to the habitability of the office environment. Specifically, this design information relates to the various individual work stations such as open area, multiple person work stations where each occupant has his/her own "space within a room." The following design information has been generated from an analysis of the data of the total test sample of 111 persons; however, the various subgroups have fewer persons.

ISSUE: GENERAL PRIVACY ADEQUACY AT MY WORKSTATION

There were 24 persons assigned to enclosed offices (with doors) both before and after the renovation; 46 persons were assigned to the multiperson open areas both before and after renovation. This diagram presents their before and after responses to various aspects of their workstation privacy. There were four aspects that generated a statistically significant response improvement for those in an "open-area" workstation, and there were two such aspects for those in "enclosed" offices. The "noise through the wall" probably did not disturb those in the open area since the building walls were further away from them than from those in the enclosed offices with close walls. It is obvious that open area "spaces within a space" give the occupants no *control* of their spaces.

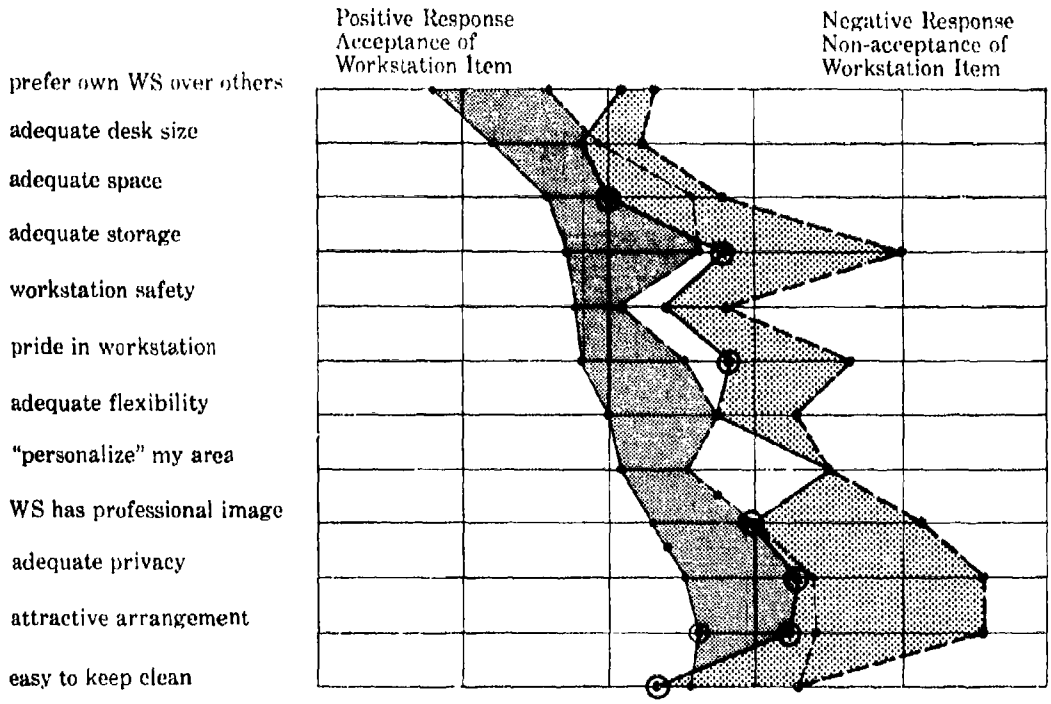


•	plot of mean of responses for differentiated group
◉ or ◉	significant level of increase in positive response
	enclosed office increase in positive response
	"open area" workstation increase in positive response

Figure 1. General privacy at workstation.

ISSUE: ACCEPTABILITY OF WORK STATION IN GENERAL

There were 24 persons assigned to enclosed offices (with doors) both before and after the renovation; 46 persons were assigned to the multiperson open areas both before and after renovation. This diagram presents their before and after responses to various aspects of their own workstations. There were seven aspects that generated a statistically significant response improvement for those in an "open area" workstation, and there was one such aspect for those in "enclosed" offices.



•	plot of mean of responses for differentiated group
◉ or ◉	significant level of increase in positive response
	enclosed office increase in positive response
	"open area" workstation increase in positive response

Figure 2. Acceptability of workstation in general.

Where necessary, the total sample was differentiated into these subgroups so that the occupant responses were, in fact, directly related to the physical components. Subgroups were differentiated on the basis of *number* of partitions enclosing an open-area workstation, or the *height* of partitions at the open-area work stations, or physical distance, etc.

The information derived from the responses of several persons differentiated into subgroups needs to be considered primarily as guidance rather than universal recommendations. The people who actually occupy a specific work station should be the final "decision makers" on all environmental factors that can be individualized—such as task lighting level, chair height, storage and work surface relationships, etc. This orientation to design guidance is relevant to both the initial design/approval team and the continuing supervisors (or middle management) of the staff located at (or in) the work stations.

The following text is presented in terms of a problem statement followed by four complementary types of design information: requirements, criteria, research commentary, and guidance. Each information type is defined as follows.

Requirements

Qualitative statements of objectives for facilities. In performance language, they are defined as statements of discrete technical need or expected results for a facility, based upon the activities to be accomplished.

Criteria

These are statements which are inferences from requirements and which form the basis for determining whether a purported solution satisfies those requirements. Criteria are usually in a form that can be measured-quantified.

Research Commentary

This is a statement describing the rationale for establishing a criterion or guidance. The statements include such things as why a criterion has been selected, why a particular limiting value of a measure was chosen, and why satisfying the criterion will also satisfy the requirement. Commentary statements may also explain why a particular requirement does not have a specific criterion measure; i.e., if the requirement is related to "qualities" of the environment.

Guidance

This is advice regarding the application of design information in facility planning, design, or operation.

Each of the following design information sheets relates to one of the occupant factors indicated in Chapter 3 for either optimum tasks performance (Function) or optimum occupant satisfaction (Privacy, Comfortable, Adaptability, Territorial, Image).

FUNCTION—DISTANCE BETWEEN OFFICE WORK STATIONS

Problem Statement

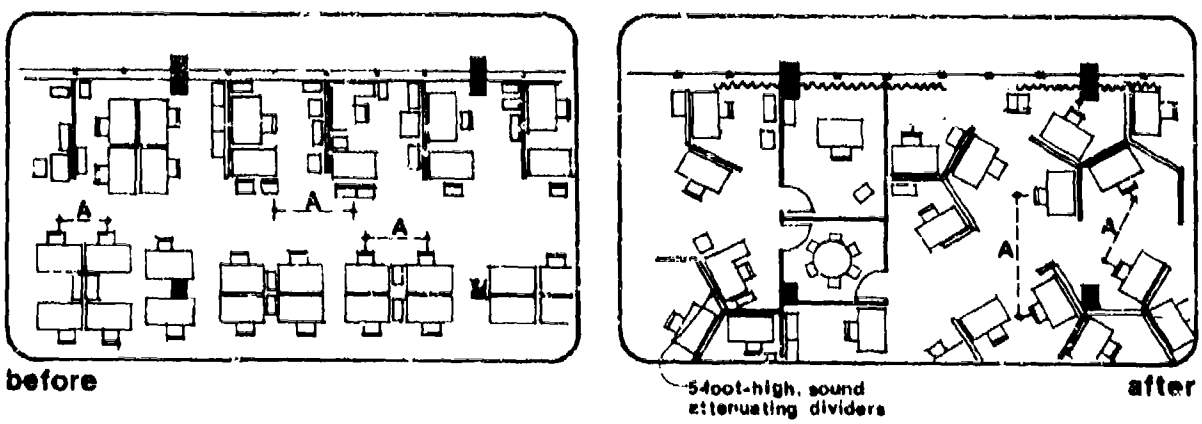
Distances between workstations could affect levels of communication and generation of noise. These may in turn affect the functional office use when the individuals are disturbed or irritated.

Requirement

In interviews and on questionnaires, office workers indicate a requirement for work concentration. One of the variables associated with the layout of office areas is that dealing with the transmission of noise from desk to desk in an open office area. The two major generators of this noise are conversations at other desks and telephone noise. Therefore, in planning an office area, it is useful to know if distance to the nearest desk has any mitigating effects on the disturbances of these two variables.

Criteria

There are no specific criteria dealing with distances between workstations even though there are space criteria in FAA documents which specify the total area at a desk workstation. Obviously, this specification somewhat implies the distances between desks, but in other FAA documents dealing with office layout, desks are placed back to back.



before

after

Research Commentary

Measurements of the distance to the nearest coworker from each of the individuals in the "open" before and after office areas were taken from the plans. This created a total sample of about 70 people. These people were then divided into three groups defined by their distance to the nearest chair. The groups were 1 to 5 feet, 6 to 10 feet, and 11 or more feet. Cross tabulations were then run for percentages across two questions dealing with conversations that disturb the individual and telephone noise as an irritant.

The tables below indicate that there was a general reduction of irritations from both conversations and phone noise in the after condition for almost all distances. It is important to notice the tendencies within the individual cells. Inspecting the individual cells, note that there is no general tendency relating irritations to distances in the before renovation condition. In the after condition, however, 11 or more feet was clearly enough distance to mitigate the irritations for the majority. With no sound attenuation at the workstations themselves, the disturbances are probably more related to the individuals and work involved than distances. Where attenuation surfaces are provided, distance plays a significant role.

Q. 88: *Conversations* in my room disturb my ability to concentrate.

distance to nearest desk	% agreeing	
	before renovation	after renovation
1–5 ft.	87	60
6–10 ft.	78	70
11+ ft.	92	25

Q. 91: The *telephones* in my room are a noise irritant.

distance to nearest desk	% agreeing	
	before renovation	after renovation
1–5 ft.	57	67
6–10 ft.	78	57
11+ ft.	67	38

Guidance

The hypothesis that distance has an effect on the occupant ratings of these questions is confirmed. No specific guidance is indicated for the actual distances between desks when no attenuation surfaces are used at the workstations. Noise irritations decrease significantly when workers are more than 10 feet apart and have the attenuation of carpet and dividers.

FUNCTION—NUMBER OF OCCUPANTS IN A LARGE ROOM

Problem Statement

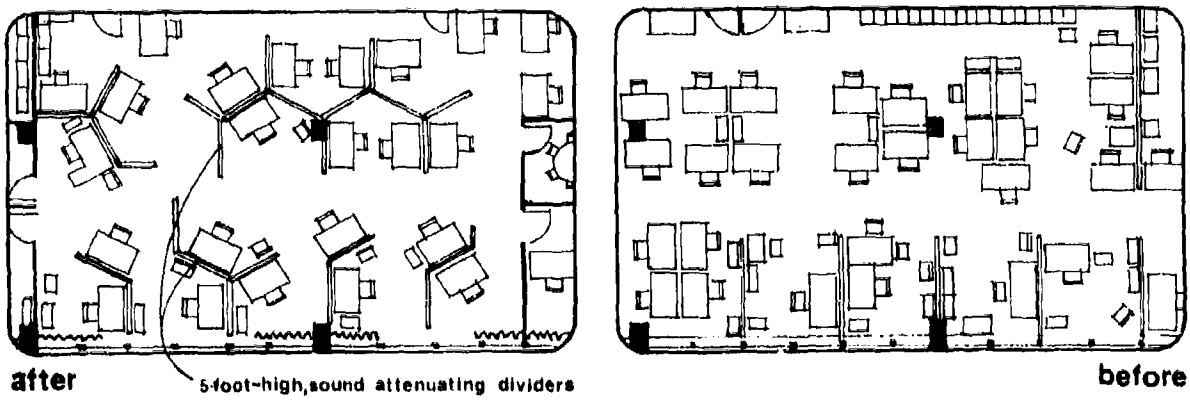
The greater the number of occupants in a single room, the more probable it is that there will be problems with traffic circulation, noise level, and distractions caused by various kinds of interferences.

Requirements

No specific requirements are outlined in any office planning literature; however, the implicit assumption on the part of designers is that office occupants may relate the professional image of a workstation to the number of people in a room.

Criteria

No government criteria specify the number of staff workers that should be in a single room.



Research Commentary

Three variables are related to the number of occupants in a room: those dealing with adequacy of overall area, flexibility of individual workstation, and overall professional image. The respondents in the before and after conditions, who were in the open office area only, were divided into four groups: (1) those having two to four people in their room, (2) those having five to eight, (3) those having nine to thirty-five, and (4) those with more than thirty-six people in one room. In every instance, the after condition is rated more positively than the before condition.

Q. 17: The *area my space* occupies is adequate for my tasks.

no. of people in room	% agreeing	
	before renovation	after renovation
2–4	76.5	100
5–8	42.9	66.7
9–35	43.4	66.8
36–90	37.0	*

Q. 19: I find my *work station flexible* enough to meet changing requirements.

no. of people in room	% agreeing	
	before renovation	after renovation
2–4	47.1	50.0
5–8	38.1	66.7
9–35	34.8	48.0
36–90	11.1	*

Q. 20: I think my work station presents a *professional image.*

no. of people in room	% agreeing	
	before renovation	after renovation
2–4	17.7	61.6
5–8	33.3	66.7
9–35	4.3	46.1
36–90	3.7	*

*No rooms this large exist after renovation.

There is a definite loss in the perception of flexibility of workstation as one goes from a room occupancy of eight to nine individuals. Also, the professional image of the workstation dramatically decreases in the after condition as one goes from a room occupancy of group 2 to group 3. This same trend does not necessarily appear in the ratings of room adequacy, probably because minimum floor areas are guided by FAA specifications, and increases in room occupancy will not necessarily decrease the amount of floor area an individual is given. The professional image of workstations is much more related to the character of the workstation furnishings in the "after" environment than to the number of occupants in the "before" environment.

Guidance

The implication is that open area room occupancies from two to eight people for work groups seem to be most acceptable. Where individual branches and divisions are larger than this, the design should provide a means of keeping room numbers at an optimum level.

FUNCTION—ADEQUACY OF LIGHTING AT THE WORKSTATION

Problem Statement

Before renovation, the lighting at the work surface was measured. On some areas of typists' desks, the level falling on the typist's keyboard surface was as low as 30 footcandles. In other areas the light falling on an engineer's workstation desk was as high as 130 footcandles. There were many complaints about lighting.

Requirements

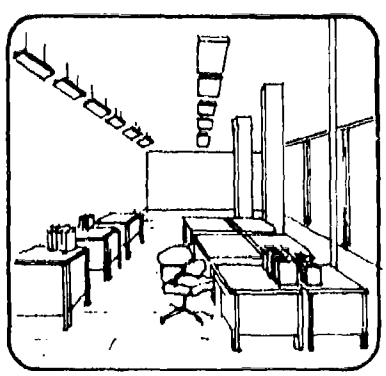
The workstation lighting must be adequate for the assigned task, with a minimum amount of glare and reflections.

Criteria

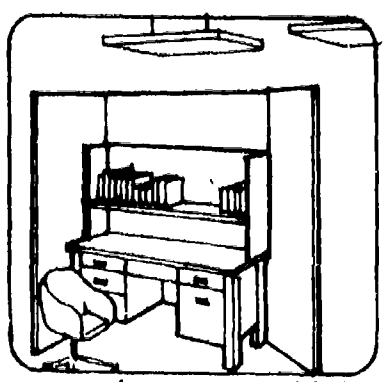
Numerous criteria in literature deal with the amount of footcandles at work surfaces. Over the past few years, combining the number of footcandles with an attempt at energy conservation has been emphasized. Recently, criteria specified by GSA have stated that the level for close writing tasks should be between 60 and 80 footcandles on the work surface.

Research Commentary

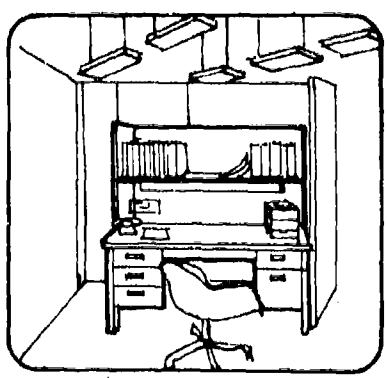
Three groups of respondents were compared: (1) those in open office environment before renovation; (2) those with carrel units without lights after renovation; and (3) those with carrel units with lights after renovation. These groups were compared with their ratings of desks, of dark-light perception of the room, and for adequacy of lighting. In the renovated condition there is a significant reduction in ratings of lighting adequacy for those workstations without lights on their carrels. Also, the ratings for carrel units without lights are lower than the ratings for carrel units with lights in the after condition.



1 before



2 after (without carrel light)



3 after (with carrel light)

Q. 31: My room is:

	dark 1	2	3	4	5	6	light 7
before renovation	% 2	3	7	21	10	30	27
after carrels w/o lights	% 4	4	14	32	9	27	9
after carrels with lights	% 0	10	8	24	16	24	18

Q. 76: My lighting is:

	adequate 1	2	3	4	5	inadequate 6	7
before renovation	% 20	22	12	21	6	8	10
after carrels with lights	% 14	18	23	14	0	23	9
after carrels w/o lights	% 27	20	10	20	7	15	2

The explanation for this change in ratings is that there were no partitions in the before condition so that the ambient room light was totally available at all workstations. Partitions installed during renovation tended to cut out some of the daylight and light from the overhead ceiling lights. Therefore, the shadows cast by the partitions on the desk surfaces made the lighting less satisfactory. The addition of lights on the carrel units improved the top two ratings of lighting adequacy from 42 percent in the before condition to 47 percent in the after condition; whereas the lighting adequacy evaluation in the after workstations *without* the carrel fixtures decreased to only 32 percent.

Guidance

Desk lighting is an extremely complex variable since many of the rooms in which it occurs probably have exterior light. However, with 5-foot-high partitions defining the workstations, it is necessary to supplement the ambient lighting; e.g., carrel unit fixtures. This also is an energy conservation measure in which the footcandles at the work surface from a carrel light unit require less energy than those coming from an overhead ceiling fixture.

FUNCTION—CONFERENCE ROOM USAGE

Problem Statement

Before renovation, engineering team leaders held many conferences in open office areas, distracting office occupants not involved in these conferences. A typical conference of five people might distract an open office area containing 40 persons.

Requirements

It is required that conferences in engineering areas be held with some degree of privacy so that individuals can freely communicate without disturbing others.

Criteria

There are no criteria dealing with specific design or location of open office areas for conferences.

after-workstation

conference in workstation-after

Research Commentary

Respondents to questions dealing with conference room usage were the equivalent of principal investigators, scientists, and engineers. Therefore, the results reported are generally useful for the middle management staff engaged in scientific or engineering activities.

In the first table below dealing with the number of conferences per week, 62 percent of the occupants attend one to three conferences each week. The table dealing with the location of conference activities shows that over half these conferences (53 percent) occurred at the work space; that is, the work space of the individual answering the questionnaire or the desk of someone else. Forty-two percent of the respondents indicated that most conferences seemed to be on a more personal level with two to three people attending. This confirms the supposition that most conference locations are in the work space. The duration of most conferences reported (61 percent) in the next table is up to 30 minutes.

Q. 2: During an "*average work week*," how many conferences or meetings will you participate in?

number of conferences held per week	0	1–3	4–6	7–9	10+
% of respondents attending per week	% 14	62	17	5	3

Q. 3: Where are your conferences most frequently held?

work station	private conf. room	someone else's desk
% 38	46	14

Q. 4: Not including yourself, how many other persons will usually participate in these conferences?

1	2–3	4–5	6+
% 12	42	22	24

Q. 5: What is the typical duration of these conferences?

1–10 min.	10–30 min.	30–60 min.	60+ min.
% 18	43	29	10

Therefore, in viewing the data overall, one might say for engineering/scientists' activities, most conferences are brief and occur in or near the work space itself, if not at the workstation. The other frequent type of conference is one engaging over four people, probably in a private conference room.

Guidance

The data indicate that provision should be made for small, brief conferences at the workstations. Generally, this can be accommodated by simply placing an extra chair or chairs in the workstation areas. It is, however, important to note that the frequency of conferences is interactive with the perception of privacy in open area offices, and that this factor may contribute to the low ratings of the initial open office areas.

Additionally, another kind of conference room required for this particular type of staff is a small room of 100 to 140 square feet with a table accommodating four or five persons. The frequency of conferences per week, as perceived by the staff, would indicate how many of these conference rooms will be required in any particular office area. This guidance still presupposes that a very large conference room is available for large meetings of up to 30 or 40 people.

FUNCTION—STORAGE ADEQUACY AT THE WORKSTATION

Problem Statement

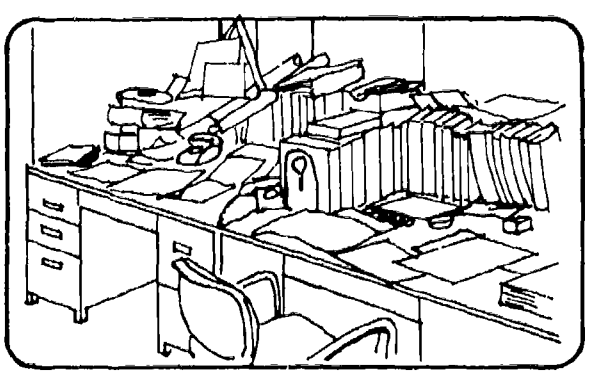
In both the photographic investigation of the NAFEC office before renovation, and in the documentation from the overall survey, it was obvious that there was too much reference literature to be efficiently kept on the engineers' desks. As the desk reference material storage problem increased, easy access became more difficult. These documents took up space on the desks and could not easily be retrieved without being on the desk surface, thereby cutting down on the working surface area of the desk.

Requirements

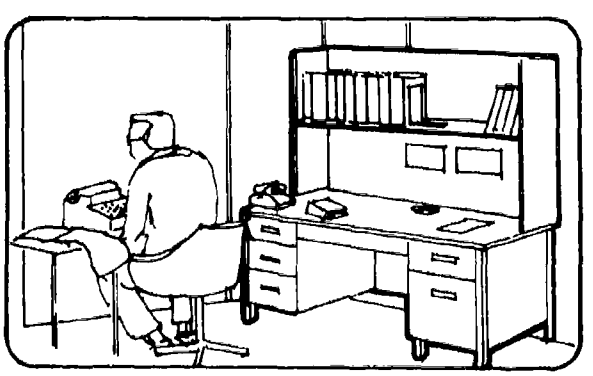
Some designers believe that storage can be grouped into items that can be immediately retrieved for quick reference and those items which are minimally retrieved. The quick reference items must be at hand to be retrieved during a telephone call, as an example. The long storage items are reference documents dealing with things like formulas, engineering criteria, etc., which are looked up during the work process. There is a design requirement for the accommodation of these two types of storage.

Criteria

There are no specific criteria dealing with storage extent and types.



before



after

Research Commentary

In the before and after condition, overall storage space did not change at all; that is, the desk storage and file storage remained the same. Probably one of the largest improvements made was the addition of carrel units which sit on top of the desks and provide a work shelf for quick reference material, such as engineering documents, FAA regulations, etc.

Q. 18: I have enough *storage space* in and around my desk

	highly agree	agree slightly	neutral	disagree slightly	highly disagree
before renovation	% 10	15	10	26	40
after renovation	% 21	28	14	20	16

The occupants of the open office areas before renovation (without carrels) were compared to those who had carrels after renovation (all occupants had carrels after renovations) and rated their storage adequacy significantly higher.

Guidance

Carrel units on top of the desks should be provided for those groups who need quick retrieval reference documents. Another means of solving this problem would be a work shelf attached to a partition.

FUNCTION—SPACE, STORAGE FOR LABORATORY WORK AREAS

Problem Statement

Because of the nature of the engineering research tasks at NAFEC, there is a very close relationship between the tasks performed at an office desk and a laboratory environment. Problems exist, however, in terms of the arrangement of the laboratories and their proximity to office areas.

Requirements

In most cases, laboratory requirements are defined on a very individual task level and the particular arrangement of the various workstation items (such as shelves, desks, tables, tool benches, etc.) is generally left to the staff in that area.

Criteria

None exist other than grade level area allowances.

Research Commentary

An attempt was made to improve the working conditions in all of the laboratory areas. The purpose of these laboratories was to support various kinds of experiments being run at the facility. As such, there was a close relationship between the technicians at the laboratory work bench and the engineers who had defined the methodology for the experiment at their office workstations.

The individual work bench areas were improved with new partitions and better arrangements for work station furnishings. Although an evaluation was made in the before and after conditions, not enough technicians were involved in laboratory work to allow reliable statistical analysis or comparison of before and after renovation. However, observational data in this case has some validity since all individuals in the laboratory area were interviewed for their perceptions. There were five main categories to their responses:

Privacy

Most respondents indicated some need for privacy. Generally this is not recognized in the laboratory environment, in which work benches are long, linear spaces with individuals sitting next to each other. In the after condition, a layout design was tried where each individual work bench was surrounded by two partitions so that each technician had a visually private space. The interviews supported that this was a better arrangement because it increased privacy.

Storage

Storage of electronic support components presented a general problem for all of the technicians in almost all of the laboratory areas Not only was there a need for accessibility to parts in testing equipment, but some of the racks built for various experiments had to be stored for long durations. There was not adequate storage space for this. The accumulation of dust and bumping hazards to equipment necessitated a great deal of time spent in retesting equipment after it was constructed.

Shelving

Almost all individuals in laboratory areas indicated a lack of adequate shelving above the work surface to place frequently used testing equipment. After renovation, such shelving was available in three laboratory areas. Interviews with the technicians indicated that this was a great improvement over the earlier condition where frequently used equipment simply sat on the work bench, taking up work surface area.

Work Space

Laboratories generally have limited space available for equipment. However, the amount of equipment continues to grow in relation to the number of experiments and the activity in the area. All interview respondents indicated a need for greater work area in terms of square feet of floor space. The renovation did not solve this need.

Noise Generation

Because of the working relationship between the engineers who design the experiments and the technicians who conduct the instrumentation for experiments, their workstations should be close together. Before renovation, laboratory areas were directly exposed to office areas. Noises from testing equipment, cooling fans, high speed motors for aircraft equipment, and conversational noise generated a great deal of occupant irritation in the office area. After renovation, the vision screens also provided acoustic attenuation that reduced staff irritation.

Guidance

Although there are no statistics to verify the precepts presented above, it does seem that the five issues mentioned apply directly to the expressed improvement of laboratory spaces. Laboratory work area space has the same need for storage, work surfaces, privacy, and noise attenuation that there is in office areas.

PRIVACY—MAJOR COMPONENTS OF PRIVACY

Problem Statement

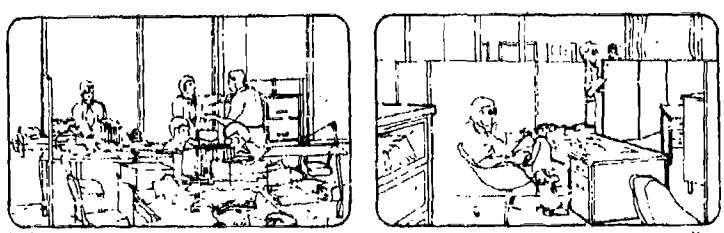
In the initial interviews, privacy was indicated as one of the many major problem areas. It is useful for the designer to know what physical components of the environment relate to the occupants' rating of privacy.

Requirements

In interviews and on questionnaires, office workers indicate a requirement for adequate privacy at their individual work stations. What adequate privacy means, however, is not specified in any document.

Criteria

There are no specific criteria dealing with workstation privacy. Privacy has many possible components: control of noise level, irritation, interruptions, individual distractions, etc. Almost none of these are covered in any criteria documents. Perhaps the only recommendation is that average noise levels in moderately quiet offices should be between 55 and 65 dBA.



before after

Research Commentary

In the experiment, the perception of privacy was questioned in a number of ways. In the data analysis, a multiple regression process was used to see what the "adequacy" of privacy meant to individual office occupants in terms of its component items. Statistically, this regression analysis gives an "equation" of the components that make up most of the variance in the concept of privacy.

These regressions were done for both the before and after conditions in an attempt to indicate that, although privacy may have improved in the renovated condition, the overall components of privacy may remain the same. Responses to open workstations before renovation were compared to the same—though partitioned—workstations after renovation. The ratings suggest that there was a major improvement in privacy.

Q. 21: The *privacy* I now have is adequate for my tasks.

	agree	neutral	disagree
before renovation	% 16	13	71
after renovation	% 33	21	46

The multiple regression was run to create equations dealing with ratings of adequate privacy for the before and after conditions. The equations show three major components are related to the concept of adequate privacy: (1) the disturbance from other persons coming into your area, (2) the disturbance of conversations in your area, and (3) the degree of control over your privacy.

before renovation	adequate privacy (Q. 21)	=	3.458	+ .800	disturbance due to people intrusions (Q. 90)	+ .345	adequate control of privacy (Q. 92)
after renovation	adequate privacy (Q. 21)	=	3.070	− .347	disturbance due to conversation (Q. 88)	+ .285	adequate control of privacy (Q. 92)

Although the *control* of privacy remains the second most important component of the concept of overall privacy, the other primary element changed. Before renovation, people coming into an individual's area were indicated as being disturbing, whereas after renovation, disturbance through conversation was indicated as the most significant factor. (Apparently, the partitions blocked out the visual movement intrusions.)

Guidance

Three occupant concerns make up most of the variance in the workstation privacy. The physical components indicating these possible environmental design implications are:

(1) *Others coming into your area*: Use partitions to form individual workstation modules to inhibit "flow-through circulation" in the work areas and block occupants' views of each other.

(2) *Conversation disturbance*: Use carpet and sound-attenuating partitions to modify conversation noise at the source. Further improvement might be obtained by masking conversation sound frequencies with white-sound generators.

(3) *Control of privacy*: The impact of visual distractions can be reduced by the use of partitions enclosing a workstation. Separate office rooms with doors are probably the main way to achieve privacy control.

PRIVACY—WORK STATIONS FOR HIGH CONCENTRATION TASKS

Problem Statement

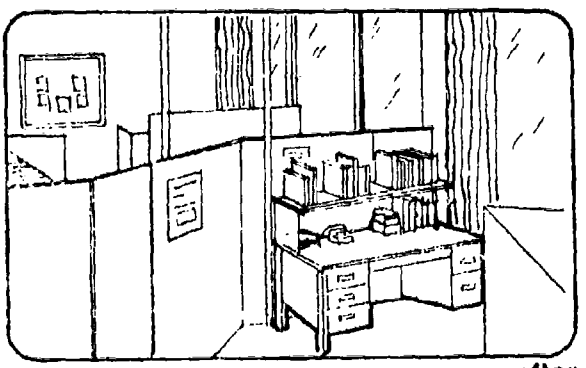
Office workers vary in their needs for concentration to accomplish tasks. It is probable that various kinds of furniture arrangements could accommodate these varying needs.

Requirements

It is generally assumed that higher-concentration tasks require more occupant isolation.

Criteria

None exist specifically dealing with concentration levels.



after

Research Commentary

Since there seems to be some consensus that individuals who require high concentration should have workstations that are somewhat different from those who require less concentration, it seemed reasonable to suppose that the relationship between work station and degree of required concentration should be investigated. The respondents involved in testing this hypothesis were only those individuals in open office areas in the before and after survey.

Respondents were grouped into those who feel their tasks require *high degrees of concentration* and those who felt their tasks did *not* require a high degree of concentration. They were further grouped for each of the before and after surveys.

Q. 10: I am *satisfied* with the furniture in my work station.

		agree	neutral	disagree
before	high	% 24	25	52
	low	% 29	24	48
after	high	% 53	15	32
	low	% 47	24	29

The results indicate a difference between those requiring high and low concentration for the before and after condition dealing with satisfaction with the furniture. That is, the type of concentration required to accomplish the task appeared to affect how the furniture satisfaction is rated. Those occupants with a *high* concentration need felt the after condition of separated workstation modules significantly better (an improvement of 29 percent agreeing they are satisfied with their workstation).

Guidance

It seems reasonable to suppose, based on the foregoing data, that a group of individuals requiring high concentration need some form of isolation for privacy and reduction of noise. This isolation may take the form of partitioning, enclosed offices, or smaller work areas.

If there are groups of individuals who require very high concentration, the best means of providing them with the environmental conditions necessary for accomplishing their tasks is either through private offices, isolation in smaller individual rooms, or temporary isolation (e.g., in a small conference room).

PRIVACY—PROXIMITY TO CIRCULATION PATHS

Problem Statement

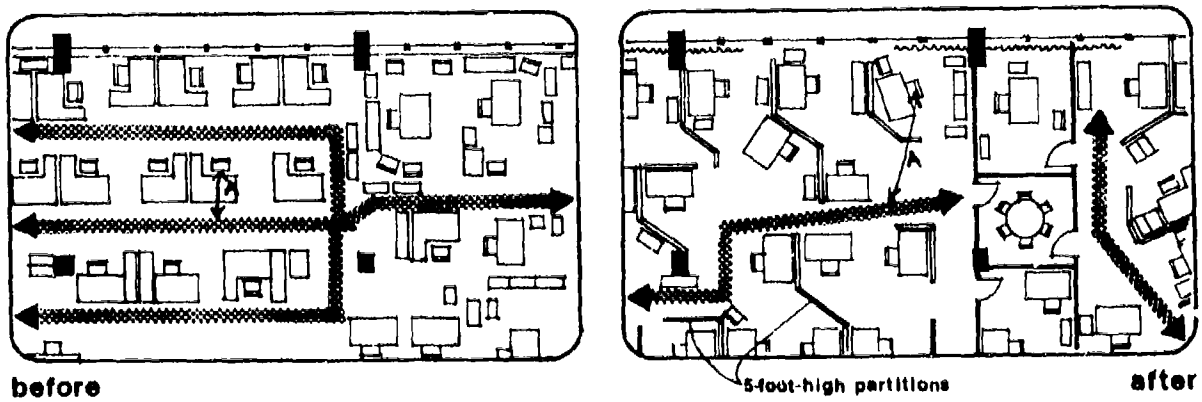
Many distractions occur in open offices because of the passage of persons near a workstation. These distractions can be modified by the extent and location of circulation paths.

Requirements

Office workers have a requirement for privacy from circulation paths in open office areas.

Criteria

No specific criteria deal with the relat'onships between circulation and lack of privacy (as distractions from noise and movement).



before after

Research Commentary

Before renovation, the major circulation paths were directly through the open work areas of exposed workstations. This was changed so that most circulation was in the hallways and the workstations were "enclosed" with 5-foot-high partitions. The distance from a circulation path was used as a design variable; respondents were thus divided into four groups: (1) those 3 feet away from the circulation path, (2) those 4 to 6 feet, (3) 7 to 9 feet, and (4) 10 or more feet as measured on the plans. Their responses to items dealing with (1) conversations as a disturbance, (2) people coming into their areas, (3) visual distractions, (4) control of privacy, and (5) perception of adequate privacy were analyzed.

Results presented in the tables below indicate "general" improvement across all variables in the after (partitioned) condition. However, the distance of 10+ feet away is consistently the category of *major* improvement. It would appear the 10-foot distance is a threshold where the visual and acoustical attenuation components (of the after condition) accomplish their design purpose.

Q. 88: *Conversations* in my room disturb my ability to concentrate.

distance from circulation path	% agreeing		
	before renovation	after renovation	
			improvement
3 ft.	90	75	+15
4–6 ft.	57	83	−26
7–9 ft.	92	76	+16
10+ ft.	86	52	+34

Q. 90: *People* keep coming into my room and disturbing me.

distance from circulation path	% agreeing		
	before renovation	after renovation	
			improvement
3 ft.	91	62	+29
4–6 ft.	57	71	−14
7–9 ft.	69	46	+23
10+ ft	77	24	+53

Q. 92: I have a *high degree of control* over my privacy in my room.

distance from circulation path	% agreeing		
	before	after	
			improvement
3 ft.	*	13	—
4–6 ft.	*	*	—
7–9 ft.	15	23	+ 8
10+ ft.	7	32	+25

*none were identified for this location.

Q. 93: I have many *visual distractions* in my office which are disturbing.

distance from circulation path	% agreeing		
	before	after	
			improvement
3 ft.	48	25	+23
4–6 ft.	43	28	+15
7–9 ft.	17	29	−12
10+ ft.	57	18	+39

Q. 21: The privacy I now have is adequate for my tasks.

distance from circulation path	% agreeing		
	before	after	
			improvement
3 ft.	10	31	+21
4–6 ft.	7	17	+10
7–9 ft.	23	35	+12
10+ ft.	7	45	+38

Guidance

It has always been good design practice to keep circulation paths away from work areas. In open office planning, this is difficult since almost any path between two workstations is a reasonable path for circulation. Since privacy is impacted by the proximity to circulation paths, the circulation paths should be short deadends that are screened from the actual workstations, with any major circulation at least 10 feet away.

PRIVACY—PERSONS VISIBLE FROM THE WORK STATION

Problem Statement

The number of persons that can be seen from the workstation can be thought of as kind of a visual distraction. Friends, people talking to friends, or movement patterns in peripheral vision obviously affect the office workers' degree of concentration.

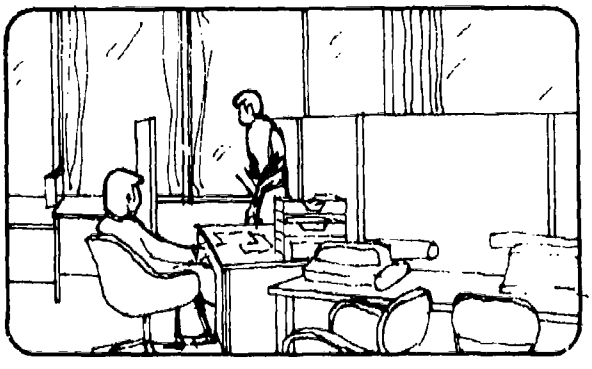
Requirements

There are occupant requirements to minimize disturbances and distractions at a workstation.

Criteria

No criteria deal with the perception of the number of people in a room.

before



after

Research Commentary

Respondents in the open office areas were divided into five groups: those able to see one, two, three, four, or five or more people from their particular workstation. Their responses to question 21 were tabulated for the before and after conditions.

Q. 21: The *privacy* I now have is adequate for my tasks.

no. of persons seen from respondent work station	% agreeing		
	before	after	
			improvement
1	40	55	15
2	29	50	21
3	25	24	-1
4	*	8	–
5 +	13	6	-7

*none existed in the before layout

Comparing the before and after conditions, privacy is consistently rated better in the condition with fewer persons in view. This tends to affirm the hypothesis that, as the number of persons one can see decreases, there will be an increase in the perception of privacy. In addition, given the workstation modules in the after-renovation condition, it appears that two persons "in view" is a threshold number where at least *half* the occupants perceive adequate privacy conditions even in open office areas.

Guidance

The design implication is that the fewer people an occupant can see, the better his/her perception of privacy, with one or two persons in view being an optimum design goal in open area offices.

PRIVACY—PARTITION HEIGHT

Problem Statement

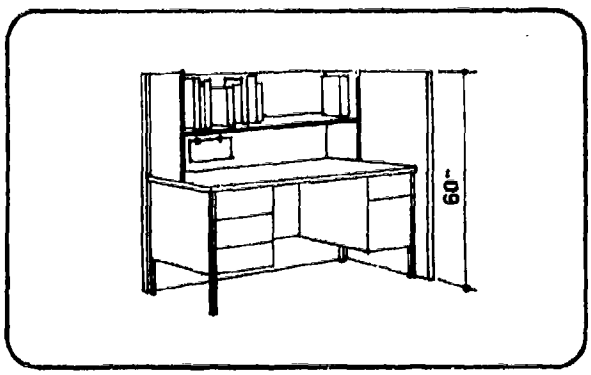
Partitions of some kind are usually part of an office environment. The height of the partition affects the privacy, noise level, and professional image of the workstations.

Requirements

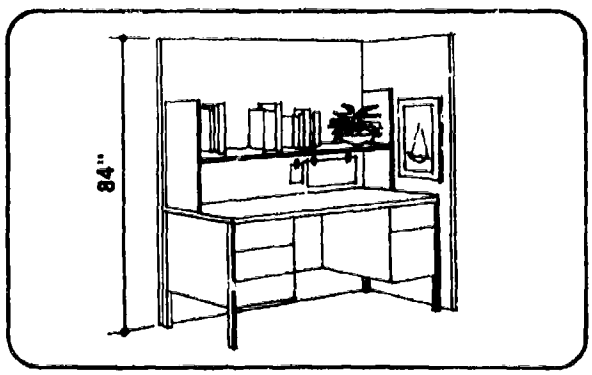
Occupants vary in their requirements for heights of workstation partitions.

Criteria

No criteria deal with partition height related to workstation quality variables.



after - low partition



high partition - after

Research Commentary

Due to the general desire for more privacy and noise reduction in the open office areas, movable modular partitions became part of the workstation design throughout. Selected areas were given high (84 in.) partitions and others were given low (60 in.) partitions. All open areas had partitions after renovation. Before renovation, there were no partitions comparable to those used in the renovation design; therefore, all occupant responses presented in the table are related to the after-renovation condition.

High vs. Low Partitions		84" (27 persons)	60" (28 persons)
questionnaire numbers	1. My furniture is comfortable.	% 49	51
	10. I am satisfied with the furniture in my workstation.	% 41	59
	17. The area my space occupies is adequate for my tasks.	% 45	55
	20. I think my work station presents a professional image.	% 33	68
	21. The privacy I have is adequate for my tasks.	% 15	58
	22. My workstation is an attractive arrangement.	% 33	67
	27. Someone else has a workstation I would prefer rather than mine.	% 56	44
	92. I have a high degree of control over my privacy in my room.	% 0	34

High partitions (84 in.) fared rather badly in the comparative evaluation. All variables were considered better with the low (60 in.) partition. In seven out of eight issues, *more than half* the occupants gave a positive response when they were at the lower partition workstation; whereas *none* of the eight variables were given a positive response by half the occupants at the higher partition workstation.

Guidance

The general conclusion to be drawn from this information is that 60-inch-high partitions produce a positive response over a wide range of variables. Therefore, higher partitions should only be used for some *specific* reason rather than for typical workstation modules.

COMFORTABLE—COMPONENTS OF FURNISHING SATISFACTION

Problem Statement

Work station furnishings for a large number of individuals can be expensive. The designer has an interest in knowing which components of a workstation contribute the most to overall satisfaction so that funds can be used to achieve optimum occupant satisfaction.

Requirements

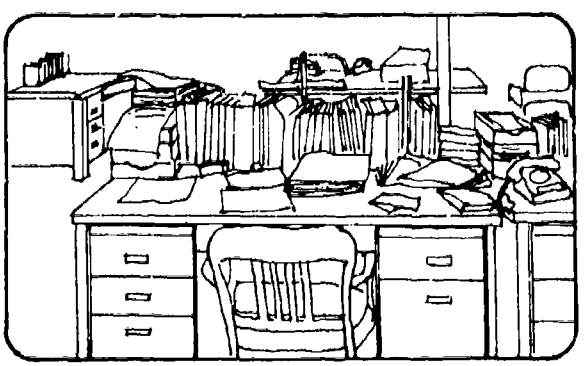
In interviews and on questionnaires, workers express a requirement for "satisfactory" furnishings.

Criteria

No criteria specifically deal with this issue.

Research Commentary

The responses of individuals in the open office areas before and after renovation were analyzed by a multiple regression run. Admittedly, the concept of furniture satisfaction is a difficult one to deal with. However, the multiple regression equations presented below indicate some consistency in the variables related to overall concept in both the before and after renovation conditions.



before

after

before renovation	satisfaction with furniture (Q. 10)	= .234 +	.484	comfortable furniture (Q. 1)	+ .380	high quality furniture (Q. 9)	+ .153	adequate storage (Q. 18)
after renovation	satisfaction with furniture (Q. 10)	= .151 +	.458	comfortable furniture (Q. 1)	+ .392	high quality furniture (Q. 9)	+ .157	adequate storage (Q. 18)

Comfort at the workstation contributes most to the total variance. Interview data indicate that "comfort" has a connotation of relating primarily to the chair. The second component in both equations is related to furniture quality, and the third deals with adequate storage in and around the desk.

Guidance

To achieve optimum satisfaction with furniture, the first priority should be the comfort of the individual, with adequate money being spent on a comfortable chair. Since all persons have unique body conformation, their chairs should be adjustable for seat height and back support. Second, enough money should be allotted to purchase good quality furniture. Finally, adequate storage should be provided for individuals to accomplish their tasks. In the equations presented above, the *size* of the desk enters into the second equation, and in this case, its contribution is so small it appears negligible.

COMFORTABLE—COMPONENTS OF FURNISHING COMFORT

Problem Statement

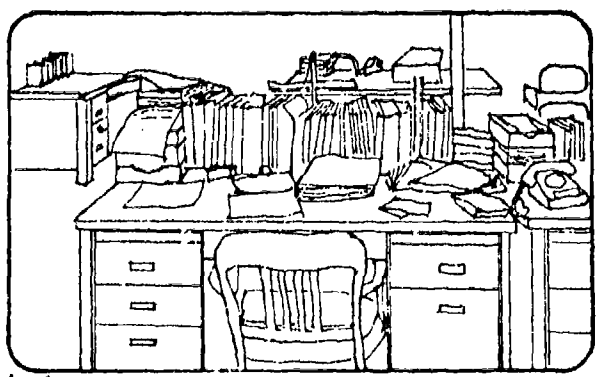
A large number of interview comments collected in the early stages of the research noted that many of the office occupants were rather uncomfortable in their present work stations. It would be quite beneficial to know the major components of comfort at the work station.

Requirements

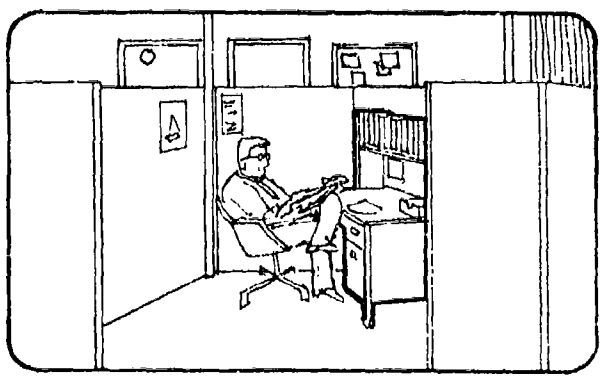
Designers and occupants of buildings assume that office workers should be comfortable while doing their tasks. Comfort might be defined as the absence of any irritation dealing with the body.

Criteria

No criteria deal specifically with comfort at the work station.



before



after

Research Commentary

It has been noted that comfort is a major component of the overall furniture satisfaction. The physical component connotation of the word comfort, determined through interviews, generally refers mainly to an occupant's chair. Still, it is useful to determine what comfort means to the occupants in terms of the workstation furnishings in general. In the before and after renovation condition, respondents in

before renovation	$\frac{\text{furniture comfort}}{\text{(Q. 1)}} = -.266 + .457\,\underset{\text{(Q. 3)}}{\text{(modern style)}} + .280\,\underset{\text{(Q. 8)}}{\text{(sturdy furn.)}} + .241\,\underset{\text{(Q. 2)}}{\text{(variety of furn.)}}$
after renovation	$\frac{\text{furniture comfort}}{\text{(Q. 1)}} = .006 + .393\,\underset{\text{(Q. 3)}}{\text{(modern style)}} + .221\,\underset{\text{(Q. 8)}}{\text{(sturdy furn.)}} + .160\,\underset{\text{(Q. 2)}}{\text{(variety of furn.)}}$

the open office area only were taken as a sample group. A multiple regression analysis was run across eight variables hypothesized to relate directly to the workstation comfort. The resulting equations indicate that there appear to be three major components dealing with comfort. The component contributing most to the overall variance is that dealing with modern style of the furniture. The second most important variable is sturdiness, and the third most important variable is the variety of the furniture.

Since the concept of comfort at the work station deals with all of the physical components of the work station, the variable dealing with modern style furniture applies to the desk, chairs, partitions, shelving, and storage as a whole. The variable dealing with sturdiness of the work station could be said to be attributed to the chair, the desk, and perhaps the partition system. Variety of furniture probably relates to the degree of adjustability individuals have with their furniture components in order to make the work area comfortable.

Guidance

If the designer is interested in increasing ratings of comfort with furniture, then attention to the general style of the furniture is probably one of the most important considerations. The furnishings should also be sturdy, and some degree of variety provided. As a comment, it is interesting to note that modern style, as a variable, has so much to do with furniture comfort. The implication is that old-styled "gray line" furniture is perceived as less comfortable than modern furniture. In the case of chairs for individual office work stations, this suggests that the designer may be better off recommending the purchase of new, modern-styled chairs, rather than refurnishing existing chairs.

COMFORTABLE—THE IMPORTANCE OF AN OUTSIDE VIEW

Problem Statement

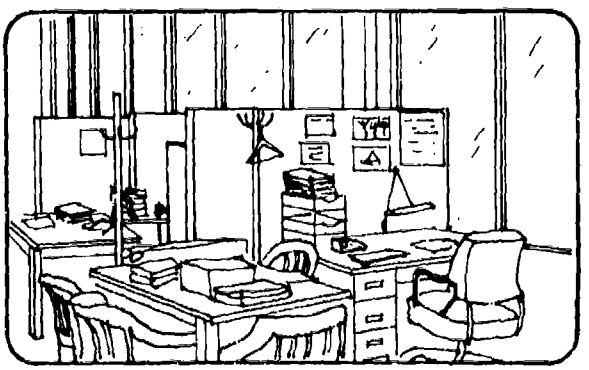
During interviews, NAFEC personnel often mentioned the view to the outside as being of prime importance. Many office occupants felt that the view to the sky, to be able to see the weather, and to be able to perceive the "time of day were very important. In most office layouts, it is usually impossible to give all people views outside.

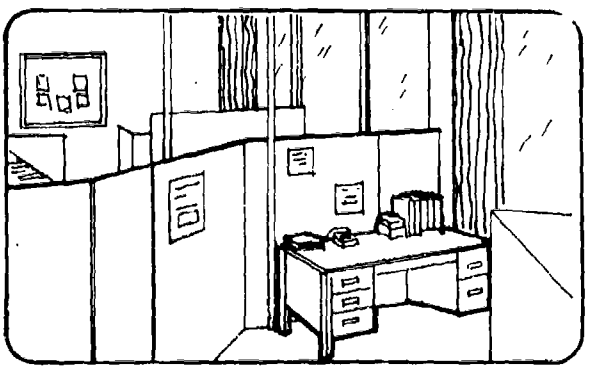
Requirements

There are stated requirements from office occupants that windows are desirable, though not absolutely necessary, in office environments.

Criteria

No criteria in any of the FAA literature deal with the necessity for a view outside.





Research Commentary

All office areas have large windows overlooking the NAFEC airport runways. Respondents in the open office condition before renovation were compared to those with both high (84 inches) and low (60 inches) partitions after renovation. The purpose was to compare the ratings of importance of being able to see outside and a window as a factor in the job. Especially noteworthy is the difference between personnel with low and high partitions in the after-renovation condition.

Once personnel have a more "acceptable" workstation, based on their requirements, the importance of having a window apparently decreases. In the after condition, those respondents with partitions had to stand up or walk around their partitions to be able to see outside. In a sense, they had an element of choice as to whether a window was used or not.

Q. 51: How important is it for you to be able to see outside?

	extremely important 1	2	3	4	5	6	not important 7
before (no partitions)	% 37	25	19	7	2	5	4
after (60" partitions)	% 10	34	15	22	5	7	7
after (84" partitions)	% 37	11	11	15	11	4	11

Q. 52: Do you feel having a window is a factor in your ability to do your job?

	yes	no
before (no partitions)	% 76	24
after (low partitions)	% 54	46
after (high partitions)	% 50	50

Guidance

It seems from these results that having a view to the outside is most important to respondents who have minimal workstation furnishings. Although these results tend to reduce the importance of having a window for office occupants, it is important to recognize that office occupants tend to crowd to a window whenever they can. Desks near windows tend to be at a high premium; therefore, one could suppose that much of the statistical research still does not capture the essence of the importance of windows to habitability.

ADAPTABILITY—FLEXIBILITY OF WORKSTATION

Problem Statement

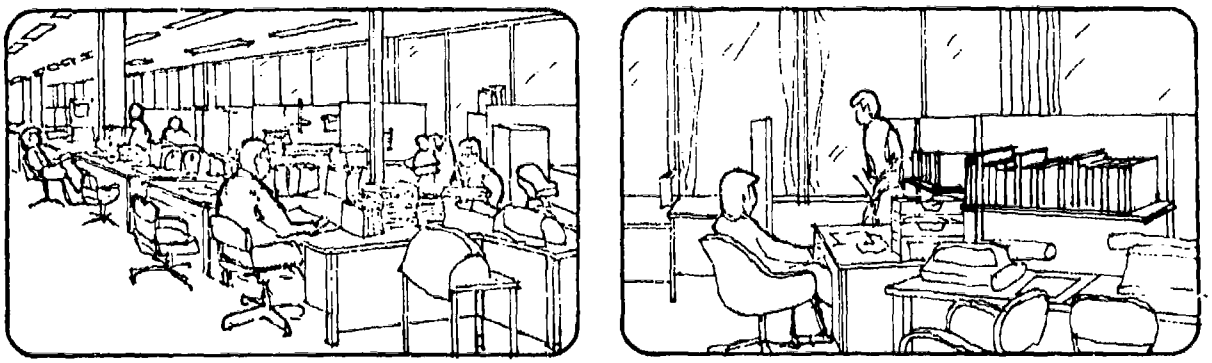
In many offices, the nature of tasks, the occupancy of the office, and the kind of communication required changes over a period of years. Many times it is necessary to adjust the workstation itself for individual tasks as they change (like changing a shelf or a light) or to change entire office areas to accommodate more people, different kinds of work teams, or changes in the nature of the organization. Open office areas without any partitions allow this to happen to some degree. However, open, partitioned office areas are sometimes perceived by designers to be more flexible. There is a question as to whether they are also perceived as more flexible by occupants.

Requirements

Currently, most office environments require interdisciplinary cooperation and the need for flexible workstations.

Criteria

Workstation flexibility is not addressed in any criteria documents.



before after

Research Commentary

Flexibility of workstation is a somewhat difficult concept to evaluate. Workstations may be flexible because they allow easy changes in small components such as shelves and lights. Or they may be flexible because they facilitate major changes like moving a branch or division to another area.

Respondents in the survey were divided into groups in private offices and groups in open areas. Responses to the question of workstation flexibility were tabulated for the before and after conditions.

Q. 19: I find my *work station flexible* enough to meet changing requirements.

	% agreeing		
	before	after	
persons in open office areas	**34**	**47**	significant difference
persons in private offices	**32**	**34**	no significant differences

Respondents in open office areas rated their workstations as significantly more flexible after renovation, whereas persons in private offices showed no significant changes in their ratings of flexibility after renovation. It can be concluded that the furniture system office workstations are perceived more flexible than simple open office areas. Since there were no organizational moves over the period of evaluation, it can also be concluded that the improved rating of flexibility is related to the individual workstations created by the partitions. This enables occupants to add shelving and bookcases and change the arrangement of the components, to accommodate individual task and personnel needs without impacting their neighbor's workstation.

Guidance

If there is a need for flexibility in the arrangement of an individual workstation, partitioned workstations in open office areas are perceived to be better than completely open office areas. However, in this guidance, flexibility must connote an individual's ability to change the arrangement of his own area. rather than the connotation of the entire branch area being flexible, since there was no experience with this factor in the experiment.

IMAGE—IMAGE OF THE BUILDING'S EXTERIOR DESIGN

Problem Statement

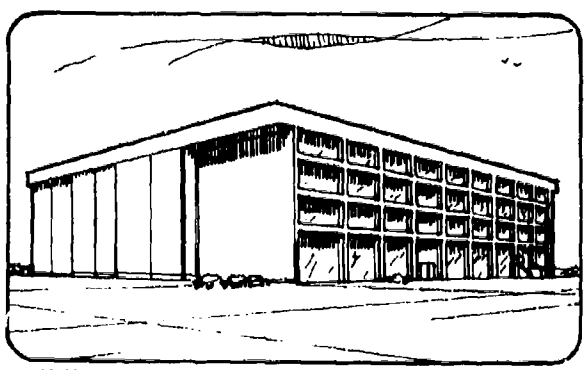
The exterior design image of a building has a great deal to do with the perception that occupants have of their total "place of work." In the office study, there was an opportunity to evaluate the perception of the building's exterior and interior in both the before and after conditions.

Requirements

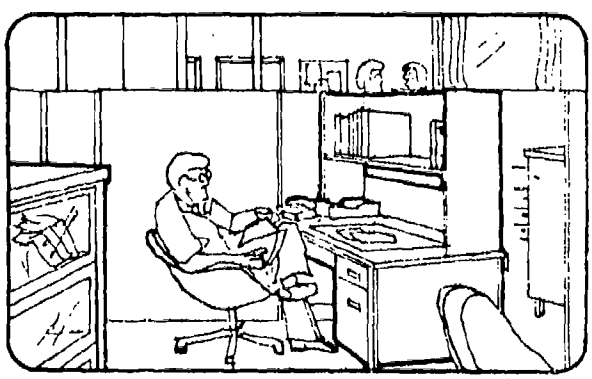
Architectural designers assume that buildings should be beautiful, habitable, and contribute to the quality of a person's life. A further implicit assumption designers have is that there is a relationship between an occupant's perception of the exterior image and the interior image of a building.

Criteria

There are no criteria dealing with the image quality of a building, either interior or exterior.



building exterior



building interior (after)

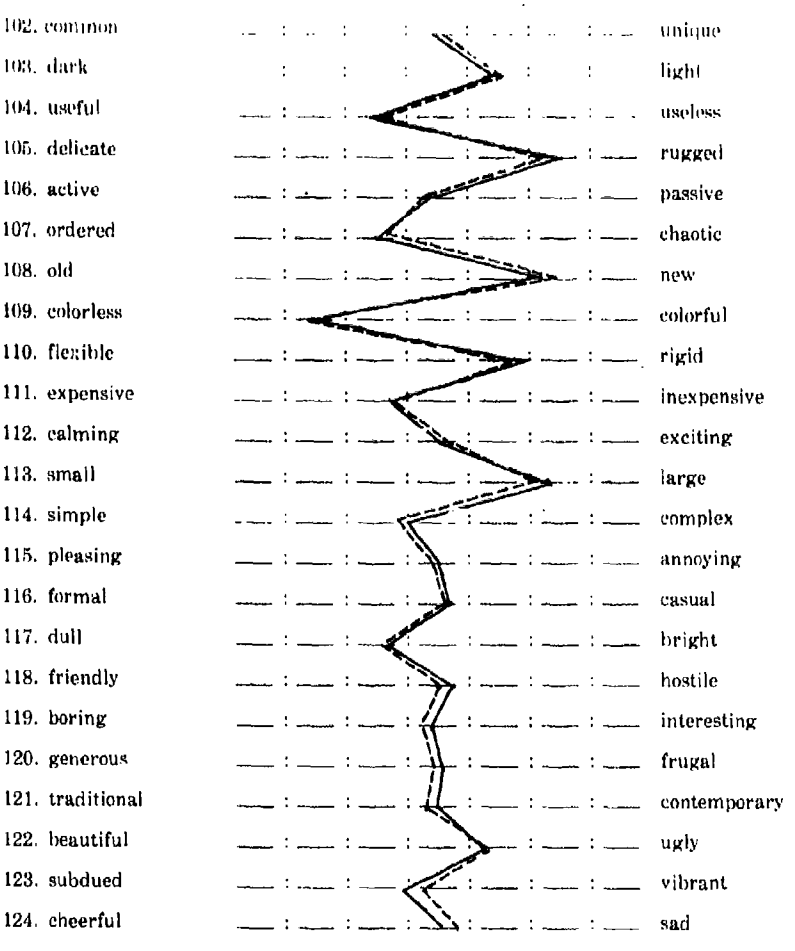
Research Commentary

A series of seven-point sematic differential scales were used to evaluate the changes in perception of the exterior image before and after renovation. There were no significant differences across 28 scales for the exterior of the building in the before and after condition. However, there were a large number of significant differences across scales for changes in the perception of the interior image. This appears to negate the hypothesis that a significant change in the interior of the building might also change the occupants' perception of the interior of the building. In this particular experiment, 95 percent of the same respondents participated in the before and after surveys. It seems that there is little relationship between the interior furnishings of the building and the occupants' perception of exterior image.

The *exterior* of your building presents an image to the public, consultants, and new employees. Please indicate your rating of the *exterior image* of your building on the scales below by placing a check mark close to the adjective which best describes some attribute of the exterior. Rate all scales.

BEFORE RENOVATION - - - - - - -
AFTER RENOVATION ———
SIGNIFICANT DIFFERENCE ●

Q. 102-124:



Guidance

An attempt by a designer to influence the perception of the exterior of the building by large-scale changes on the interior seems to be irrelevant—either positive or negative.

IMAGE—THE "PROFESSIONAL IMAGE" OF A WORK STATION

Problem Statement

The professional image of the work station is thought to be a composite measure of the overall character, adequacy, and aesthetics of the individual's workstation. This condition may also relate to individuals' image of *themselves* at the workstation.

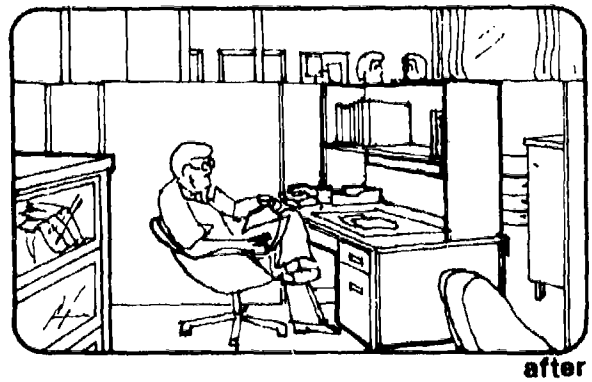
Requirements

No specific requirements that define professional image are outlined in any planning literature or in manufacturing literature. For the most part, this is probably a need related to an individual's requirement for "self-fulfillment."

Criteria

No criteria exist in the FAA facility document.

before



after

Research Commentary

To determine what environmental components might contribute to the concept of the professional image, a multiple regression analysis was run before and after renovation.

before renovation	professional image of work station (Q. 20)	= 2.15	+	.270	adequate privacy (Q. 21)	+ .270	adequate area (Q. 17)
after renovation	professional image of work station (Q. 20)	= .480	+	.410	adequate privacy (Q. 21)	+ .189	adequate area (Q. 17)

Professional image in both cases seems to be made up of the same two major components: adequate privacy and adequate area. In our culture, managers and professionals tend to have more privacy and area in their offices than other individuals. In most government offices, these variables are generally dictated by a regulation based on status rather than functional/professional needs.

Guidance

Some degree of privacy is absolutely necessary to professional image. It also appears necessary that areas allowed should not go below minimums specified. Probably more space and privacy should be given to those who need to interface with "outside professionals."

IMAGE—AESTHETICS OF THE OFFICE AREA

Problem Statement

There are a number of ways of perceiving aesthetics of open office areas. It is useful to have some guidance on the range of color and the kind of aesthetic issues that would be appreciated by occupants of office areas.

Requirements

Office workers probably require aesthetically pleasing environments in which to work; however, specific aesthetic issues, such as color preferences, are probably not requirements that affect occupant behavior.

Criteria

None exist dealing with the specific aesthetic issues in office areas.

Research Commentary

There are several ways of relating the color of offices to the furnishings. The office furnishings can be used as accent colors with muted backgrounds for the walls, the carpet, and the ceilings, or certain walls can be accent walls and the office furnishings themselves be neutral, rather quiet colors. When all of the occupants of the office areas were surveyed before and after, their preferences for specific colors did not change. However, when initially asked which color scheme they preferred, 28 percent preferred a major color with accents. When this was actually instituted in the after condition, only 18 percent felt that this was what they preferred.

Q. 168: Would you prefer your color scheme to be:

	bright	subdued	neutral	two colors	one main w/accent
before renovation	% 15	32	13	13	28
after renovation	% 20	33	13	13	18

As a corollary to these results, the major preferences for the main color in office areas, reported in the before and after condition as green and blue, also coincide with the desirability of general color preferences in the population overall.

Q. 167: If you were to paint your area, what would you choose as the MAIN COLOR or COLOR SCHEME?

	red	green	blue	brown	yellow	orange	other
before renovation	% 1	28	36	10	16	6	3
after renovation	% 1	31	24	10	14	11	9

Guidance

A designer should be aware of the preference for green and blue. Further, it seems that occupants prefer these colors to be subdued, using accents to bring out areas of interest. The least preferred color schemes were neutrals falling in ranges such as beiges or off whites, or schemes using two colors equally. The implication is that one major color with accents should be used, and that both colors should be somewhat subdued.

TERRITORIAL—WORKSTATION PERSONALIZATION

Problem Statement

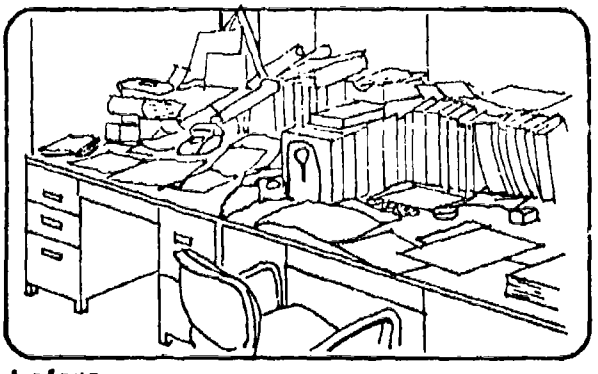
Individuals can take great pride in their work territories. Also, one way of defining workstation territory is to personalize it with pictures, flowers, photographs, or other items brought from home. Designers hypothesize that this type of personalization should be provided for. The assumption is that individuals who personalize their workstations will take more pride in them.

Requirements

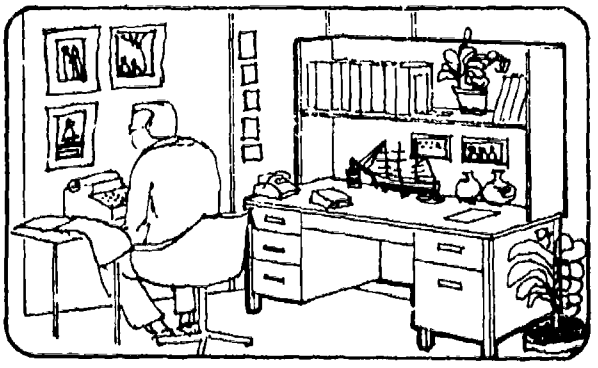
There are observable requirements for office designs to accommodate the need for occupants' personalization of their workstations.

Criteria

No specific provision is made for this in any of the criteria documents put out by government agencies.



before



after

Research Commentary

It is useful to compare employees' personalization of their workstation with their indication of pride in their workstation.

Q. 97: Do you bring objects from home or elsewhere with which to decorate your room or work station?

	yes	no
before renovation	% 38	62
after renovation	% 46	54

Q. 26: I associate a *personal sense of* pride with my workstation.

	agree	neutral	disagree
before renovation	% 24	29	47
after renovation	% 44	34	21

Guidance

It is necessary for the designer to recognize that just as people tend to personalize their homes, there also is an urge to personalize their workstations, especially when they take pride in their workstations. Therefore, some provision should be made for accommodating this form of decor with extra areas on shelves for small items brought from home or provision for personalization on partitions by hanging up pictures of family, friends, posters reflecting personal interests, etc.

6 CONCLUSIONS

Design issues are those major variables, such as distance between workstations, which the designer generally decides intuitively. His/her intuition and experience, both in design and as an occupant of similar environments, guides in the arrangement, location, and decor of the particular environment being designed.

Many of the variables the designer works with are interactive; that is, the combined effect of two variables is more than the individual effect of each one additively. This study has pointed out many of these variables relate to design issues from which guidance can be developed. It is not necessary that this guidance develop into criteria; each of these variables is related to making the physical environment more responsive for the user/occupant. Appendix C contains the initial NAFEC in-house evaluation of the after-renovation responsiveness, including a comparison of the before and after conditions as impacted on the user/occupants' desire to be at a relatively "distraction-free" workstation.

The major conclusion that could be derived from this study is that there is a feasible way helping the designer deal with these variables. Because the gap between habitability information and design application is difficult to bridge, the procedure documented in this study is considered a beginning step in a continuing process to improve both methodology and the information obtained.

This report can be used in three ways, each relating to a particular responsibility level:

1. The *designer* can use the information in the guidance statements as he/she begins selecting materials and layout of the interior office space within a new building. He/she may also use the information as a point of discussion with the client to pinpoint sensitive design and habitability issues. Finally, some of the guidance can lead to a decision which indicates a cost saving or which can justify an extra expenditure for furnishings. The use of the guidance for these purposes depends on the designer's constraints and requirements.

2. The office *manager and supervisor* can use some of the guidance information to understand the relationships between the habitability of the environment and the tasks the employees must perform. By becoming sensitive to these issues, the office supervisor can effectively manage change and flexibility both at the level of the workstation and at the level of the whole office.

3. The *office occupant* can use the information to understand how his/her needs for privacy, view, etc. interface with the physical environment and the need to accomplish tasks. By understanding these relationships with the workstation, room, and building, he/she will be able to use the resources more effectively.

APPENDIX A:
QUESTIONNAIRE

office environment research & planning

faa - nafec

A study to determine the best means of improving the quality of office space has been requested. The purpose of this study is to determine the opinions, preferences and a consensus of complaints about offices that will help the designers to improve the efficiency, comfort and attractiveness of your building. As a resident of your office area, your experience, opinions and preferences will be highly valuable sources of information to the designer concerning layout, comfort and general features of decor and construction.

This questionnaire represents a portion of that study. Your help in answering items on this questionnaire will provide a basis for improving the office situation. The questionnaire is divided into three sections:

Section I Work Area Evaluation dealing with your immediate work area

Section II Activity and Equipment Analysis dealing with your functional needs

Section III Work Environment dealing with organizational operations

The information requested by this survey will be used for research purposes only and all responses will be held in strict confidence. Your name will not be linked with your answers which will be used only for statistical summaries of the data.

Please complete the questionnaire before the next day and return it to one of our representatives.

Your coordination and assistance are greatly appreciated. If you have any questions, please contact one of the researchers or call me at the FTS number below.

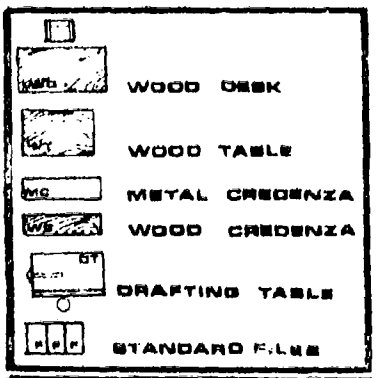
SECTION I: WORK AREA EVALUATION

1

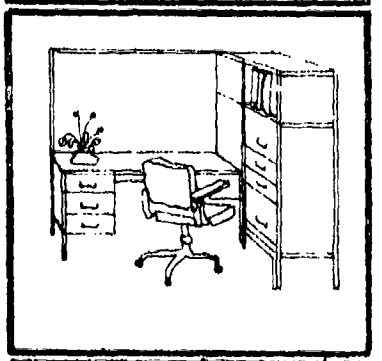
This questionnaire is designed to obtain your evaluation of, and feelings about your work area and the rest of the building. It's purpose is to supply information which will help in providing facilities for your use in the future. Please answer all questions to the best of your ability.

Below you will find sketches indicating what we mean when we ask you to evaluate a certain part of your work area:

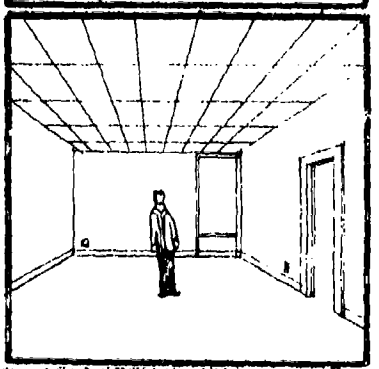
1. Furniture The actual items such as desks, bookcases, chairs, etc.



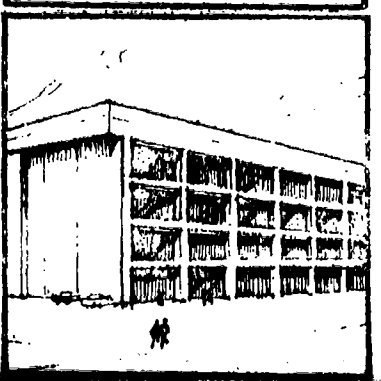
2. Work Station The assemblage of furniture and accessories you have arranged to meet your needs for your tasks.



3. Room The actual room in which you work or are stationed consisting of floors, walls, ceilings, and utilities.



4. Building The whole building or a group of buildings.



card 1
col. 1-3

Quest. No._____

FURNITURE

The furniture you have in your work station can help or hinder your job effectiveness. The furniture consists of a number of individual items which you will be asked to evaluate as a group. Please indicate your agreement or disagreement with the following statements.

	Highly Agree	Slightly Agree	Neutral	Slightly Disagree	Highly Disagree	
1. My furniture is comfortable	___	___	___	___	___	4
2. I have a wide variety of furniture	___	___	___	___	___	5
3. My furniture is modern and stylish	___	___	___	___	___	6
4. My furniture is colorful	___	___	___	___	___	7
5. My furniture is easy to damage	___	___	___	___	___	8
6. My furniture is new	___	___	___	___	___	9
7. I am proud of my furniture	___	___	___	___	___	10
8. My furniture is sturdy	___	___	___	___	___	11
9. My furniture is high quality	___	___	___	___	___	12
10. I am satisfied with the furniture in my work station	___	___	___	___	___	13

I have the following furniture in my work area (circle appropriate items)

11. Desk (14)
    1. Grey-green metal desk
    2. Wood desk
    3. Colored metal desk

12. Bookcase (15)
    1. Bookshelves
    2. Metal Bookcase
    3. Wood bookcase

13. File Cabinet (16)
    1. 2 drawer
    2. 4 drawer
    3. Slide pullout
    4. Other

14. Other Equipment (17)
    1. Credenza
    2. Chairs
    3. Work Table
    4. Other

15. Partitions (18)
    1. Bank Screen (grey metal panels with translucent dividers)
    2. Landscape Office (interconnected panels with semi-private desk areas)
    3. Movable Freestanding (a few acoustic panels between desks)
    4. None (open office area with no partitions at all)

WORK STATION

Your work station is the physical space in the room you and your office equipment occupy. Various aspects of your work station layout may affect your job performance. Please indicate the degree to which you agree or disagree with the following statements.

		Highly Agree	Agree Slightly	Neutral	Disagree Slightly	Highly Disagree	
16.	The size of my desk surface is adequate for my tasks.	___	___	___	___	___	19
17.	The area my space occupies is adequate for my tasks.	___	___	___	___	___	20
18.	I have enough storage space in and around my desk.	___	___	___	___	___	21
19.	I find my work station flexible enough to meet changing requirements.	___	___	___	___	___	22
20.	I think my work station presents a professional image.	___	___	___	___	___	23
21.	The privacy I now have is adequate for my tasks	___	___	___	___	___	24
22.	My work station is an attractive arrangement	___	___	___	___	___	25
23.	My work station is easy to keep clean	___	___	___	___	___	26
24.	I do bring items from home to personalize my work area	___	___	___	___	___	27
25.	There are no safety hazards associated with my work station.	___	___	___	___	___	28
26.	I associate a personal sense of pride with my work station	___	___	___	___	___	29
27.	Someone else has a work station I would prefer rather than mine	___	___	___	___	___	30

IMAGE OF WORK STATION AND ROOM

The work station you work with presents an image to you, your visitors, and other staff. Please indicate your rating of the image of your work station on the scales below by placing a check mark close to the adjective which best describes its attributes.

28.	cozy	___	___	___	___	___	___	___	roomy	31
29.	common	___	___	___	___	___	___	___	unique	32
30.	clean	___	___	___	___	___	___	___	dirty	33
31.	dark	___	___	___	___	___	___	___	light	34
32.	bad	___	___	___	___	___	___	___	good	35
33.	ordered	___	___	___	___	___	___	___	chaotic	36
34.	old	___	___	___	___	___	___	___	new	37
35.	colorless	___	___	___	___	___	___	___	colorful	38
36.	stuffy	___	___	___	___	___	___	___	drafty	39
37.	calming	___	___	___	___	___	___	___	exciting	40
38.	noisy	___	___	___	___	___	___	___	quiet	41
39.	small	___	___	___	___	___	___	___	large	42
40.	simple	___	___	___	___	___	___	___	complex	43
41.	pleasing	___	___	___	___	___	___	___	annoying	44
42.	formal	___	___	___	___	___	___	___	casual	45
43.	dull	___	___	___	___	___	___	___	bright	46
44.	friendly	___	___	___	___	___	___	___	hostile	47
45.	boring	___	___	___	___	___	___	___	interesting	48
46.	traditional	___	___	___	___	___	___	___	contemporary	49
47.	beautiful	___	___	___	___	___	___	___	ugly	50
48.	subdued	___	___	___	___	___	___	___	vibrant	51
49.	protected	___	___	___	___	___	___	___	exposed	52
50.	facilitating	___	___	___	___	___	___	___	distracting	53

ROOM

Your work station is in a room. Certain attributes of this room can be rated individually and make up your total perception of your space in the room. Please answer the following questions.

WINDOWS

51. How important is it for you to be able to see outside?

Extremely important ___:___:___:___:___:___:___ Not important at all 54

52. Do you feel having a window is a factor in your ability to do your job?

1. Yes 2. No 55

53. Do you feel a window:

Improves my performance on the job ___:___:___:___:___:___:___ Distracts from my performance on the job 56

54. Can you see out of any window from where you normally sit?

1. Yes 2. No (If no go on to 64) 57

55. If so what can you see? (circle as many as necessary)

1. trees 2. cars 3. fields 4. buildings 5. supplies 6. trash 58 59

56. Which direction does your window face?

1. North 2. East 3. South 4. West 60

WINDOWS IN ROOM

57.	Satisfactory ___:___:___:___:___:___:___	Unsatisfactory	61
58.	Style attractive ___:___:___:___:___:___:___	Style unattractive	62
59.	Provides adequate outside light ___:___:___:___:___:___:___	Provides inadequate outside light	63
60.	Good location ___:___:___:___:___:___:___	Poor location	64
61.	Good size ___:___:___:___:___:___:___	Poor size	65
62.	Clean glass ___:___:___:___:___:___:___	Dirty Glass	66
63.	Easy to open or operate ___:___:___:___:___:___:___	Difficult to open or operate	67

FLOORING IN ROOM

64.	Satisfactory	___:___:___:___:___:___:___	Unsatisfactory	68
65.	Clean	___:___:___:___:___:___:___	Dirty	69
66.	In good repair	___:___:___:___:___:___:___	In poor repair	70
67.	Attractive	___:___:___:___:___:___:___	Unattractive	71

CEILING IN ROOM

68.	Satisfactory	___:___:___:___:___:___:___	Unsatisfactory	72
69.	In good repair	___:___:___:___:___:___:___	In poor repair	73
70.	Attractive finish	___:___:___:___:___:___:___	Unattractive finish	74

WALLS IN ROOM

71.	Satisfactory	___:___:___:___:___:___:___	Unsatisfactory	75
72.	Easy to clean	___:___:___:___:___:___:___	Difficult to clean	76
73.	In good repair	___:___:___:___:___:___:___	In poor repair	77
74.	Attractive finish	___:___:___:___:___:___:___	Unattractive finish	78
75.	Good quality paint	___:___:___:___:___:___:___	Poor quality paint	79 80 1 Dup 1-3

UTILITIES AND SERVICES IN ROOM

76.	Lighting adequate	___:___:___:___:___:___:___	Lighting inadequate	A
77.	Fixtures well located	___:___:___:___:___:___:___	Fixtures poorly located	5
78.	Switches well located	___:___:___:___:___:___:___	Switches poorly located	6
79.	Switches in good repair	___:___:___:___:___:___:___	Switches in poor repair	7

ELECTRICAL OUTLETS IN ROOM

80. Sufficient number ___:___:___:___:___:___:___ Insufficient number 8

81. Well located ___:___:___:___:___:___:___ Poorly located 9

AIR CONDITIONING AND HEATING IN ROOM

82. Air Conditioning Adequate ___:___:___:___:___:___:___ Air Conditioning Not Adequate 10

83. Heating Adequate ___:___:___:___:___:___:___ Heating Inadequate 11

84. Easy to Adjust ___:___:___:___:___:___:___ Hard to Adjust 12

85. I am comfortable in most seasons ___:___:___:___:___:___:___ I am uncomfortable in most seasons 13

THERMAL COMFORT AT WORK STATION

86. Please rate the Thermal Conditions at your work station now as you are completing this questionnaire. 14

1. Cold
2. Cool
3. Slightly Cool
4. Comfortable
5. Slightly Warm
6. Warm
7. Hot

87. Please indicate which items of clothing best describe your apparel right now. Clothing has a significant effect upon thermal comfort and needs to be accounted for in our analysis.

	MEN		WOMEN	
Slacks plus:	short sleeve shirt _____	15	skirt _____	20
	long sleeve shirt _____	16	slacks _____	21
	undershirt _____	17	blouse _____	22
	sweater or sweater vest _____	18	sweater _____	23
	suit coat or sports jacket _____	19	jacket _____	24

PRIVACY IN WORK STATION

Privacy has many definitions, but seems to be a concept related to the nature of your tasks at your work station and in your room. Please indicate your degree of agreement with the following statements.

	Highly Agree	Slightly Agree	Neutral	Slightly Disagree	Highly Disagree	
88. Conversations in my room disturb my ability to concentrate	___	___	___	___	___	25
89. I can hear noise thru the walls of my office	___	___	___	___	___	26
90. People keep coming into my room and disturbing me	___	___	___	___	___	27
91. The telephones in my room are a noise irritant	___	___	___	___	___	28
92. I have a high degree of control overy my privacy in my room	___	___	___	___	___	29
93. I have many visual distractions in my office which are disturbing	___	___	___	___	___	30
94. My job requires a high degree of concentration	___	___	___	___	___	31

95. Total number of people in my room is _____. 32 33

96. Number of people I can see while sitting at my desk is _____. 34 35

PERSONALIZATION OF WORK STATION

We all tend to bring parts of our lives into the office setting. Sometimes we bring in objects that symbolize aspects of our lives and place them in the office areas. The following questions deal with this kind of personalization.

97. Do you bring objects from home or elsewhere with which to decorate your room or work station?

_____Yes _____No (if no skip to question 102) 36

98. If yes, please indicate the type of objects you bring. Circle one or more.

1. Photos
2. Pictures
3. Posters
4. Pencil holders
5. Coffee cups
6. Personal books
7. Plant
8. Desk ornaments
9. Wall hangings
10. Certificates, awards
11. Personal lamp
12. Radio
13. Clock
14. Other _____

99. Can you explain, in your own words, why you bring these items to the office setting?

100. Do your friends talk about these items when visiting your work station?

To a great extent ____:____:____:____:____:____:____ Not at all

101. Does your work station accommodate this form of personalization by providing space on shelving, walls, or desks?

To a great extent ____:____:____:____:____:____:____ Not at all

IMAGE OF THE BUILDING

The exterior of your building presents an image to the public, consultants, and new employees. Please indicate your rating of the exterior image of your building on the scales below by placing a check mark close to the adjective which best describes some attribute of the exterior. Rate all scales.

102.	common	___ :	___ :	___ :	___ :	___ :	___ :	___	unique	37
103.	dark	___ :	___ :	___ :	___ :	___ :	___ :	___	light	38
104.	useful	___ :	___ :	___ :	___ :	___ :	___ :	___	useless	39
105.	delicate	___ :	___ :	___ :	___ :	___ :	___ :	___	rugged	40
106.	active	___ :	___ :	___ :	___ :	___ :	___ :	___	passive	41
107.	ordered	___ :	___ :	___ :	___ :	___ :	___ :	___	chaotic	42
108.	old	___ :	___ :	___ :	___ :	___ :	___ :	___	new	43
109.	colorless	___ :	___ :	___ :	___ :	___ :	___ :	___	colorful	44
110.	flexible	___ :	___ :	___ :	___ :	___ :	___ :	___	rigid	45
111.	expensive	___ :	___ :	___ :	___ :	___ :	___ :	___	inexpensive	46
112.	calming	___ :	___ :	___ :	___ :	___ :	___ :	___	exciting	47
113.	small	___ :	___ :	___ :	___ :	___ :	___ :	___	large	48
114.	simple	___ :	___ :	___ :	___ :	___ :	___ :	___	complex	49
115.	pleasing	___ :	___ :	___ :	___ :	___ :	___ :	___	annoying	50
116.	formal	___ :	___ :	___ :	___ :	___ :	___ :	___	casual	51
117.	dull	___ :	___ :	___ :	___ :	___ :	___	___	bright	52
118.	friendly	___ :	___ :	___ :	___ :	___ :	___	___	hostile	53
119.	boring	___ :	___ :	___ :	___ :	___ :	___ :	___	interesting	54
120.	generous	___ :	___ :	___ :	___ :	___ :	___ :	___	frugal	55
121.	traditional	___ :	___ :	___ :	___ :	___ :	___ :	___	contemporary	56
122.	beautiful	___ :	___ :	___ :	___ :	___ :	___ :	___	ugly	57
123.	subdued	___ :	___ :	___ :	___ :	___ :	___ :	___	vibrant	58
124.	cheerful	___ :	___ :	___ :	___ :	___ :	___ :	___	sad	59

PARTS OF THE OFFICE ENVIRONMENT

A building is made of many parts such as halls, conference rooms, etc. Your ratings of these components will help in an overall evaluation of office space.

HALLWAYS

125.	colorful	___	___	___	___	___	___	___	drab	60
126.	interesting	___	___	___	___	___	___	___	boring	61
127.	dark	___	___	___	___	___	___	___	light	62
128.	clean	___	___	___	___	___	___	___	dirty	63
129.	friendly	___	___	___	___	___	___	___	hostile	64
130.	beautiful	___	___	___	___	___	___	___	ugly	65

RECEPTIONIST AREA (IF APPLICABLE)

131.	colorful	___	___	___	___	___	___	___	drab	66
132.	interesting	___	___	___	___	___	___	___	boring	67
133.	dark	___	___	___	___	___	___	___	light	68
134.	clean	___	___	___	___	___	___	___	dirty	69
135.	friendly	___	___	___	___	___	___	___	hostile	70
136.	beautiful	___	___	___	___	___	___	___	ugly	71

CONFERENCE ROOMS (IF APPLICABLE)

137.	colorful	___	___	___	___	___	___	___	drab	72
138.	interesting	___	___	___	___	___	___	___	boring	73
139.	dark	___	___	___	___	___	___	___	light	74
140.	clean	___	___	___	___	___	___	___	dirty	75
141.	friendly	___	___	___	___	___	___	___	hostile	76
142.	beautiful	___	___	___	___	___	___	___	ugly	77
143.	adequate	___	___	___	___	___	___	___	inadequate	78
										Skip 79
										80 ?

SNACKBAR (IF APPLICABLE)

144.	colorful	___	___	___	___	___	___	___	drab	Dup 143
145.	interesting	___	___	___	___	___	___	___	boring	5
146.	dark	___	___	___	___	___	___	___	light	6
147.	clean	___	___	___	___	___	___	___	dirty	7
148.	friendly	___	___	___	___	___	___	___	hostile	8
149.	beautiful	___	___	___	___	___	___	___	ugly	9
150.	adequate	___	___	___	___	___	___	___	inadequate	10

LIBRARY (IF APPLICABLE)

151.	colorful	___	___	___	___	___	___	___	drab	11
152.	interesting	___	___	___	___	___	___	___	boring	12
153.	dark	___	___	___	___	___	___	___	light	13
154.	clean	___	___	___	___	___	___	___	dirty	14
155.	friendly	___	___	___	___	___	___	___	hostile	15
156.	beautiful	___	___	___	___	___	___	___	ugly	16
157.	adequate	___	___	___	___	___	___	___	inadequate	17

The building is placed on a site. Some aspects of the site landscaping may be important to you. Please indicate your agreement or disagreement with the following statements.

SITE AND LANDSCAPING

		Highly Agree	Slightly Agree	Neutral	Slightly Disagree	Highly Disagree	
158.	Finding parking place <u>close to the building</u> is a problem	___:	___:	___:	___:	___	18
159.	I like to <u>spend time outdoors</u> during my lunch hour	___:	___:	___:	___:	___:	19
160.	The inclusion of <u>more trees</u> around the building would improve its looks	___:	___:	___:	___:	___:	20
161.	The landscaping makes this a <u>pleasant place</u> to be	___:	___:	___:	___:	___:	21
162.	I would like more <u>outdoor recreation</u> spots such as benches, covered places, etc.	___:	___:	___:	___:	___:	22
163.	I would enjoy plants in the interior of the building	___:	___:	___:	___:	___:	23
164.	Going outside during the day helps my ability to <u>concentrate</u>	___:	___:	___:	___:	___:	24
165.	The <u>size of the parking lot</u> is adequate	___:	___:	___:	___:	___:	25

166. What single action would most improve the quality of the landscaping.

* Perhaps at this time a cup of coffee would be a great help in continuing.....

COLOR AND DECOR

167. If you were to paint your area, what would you chose as the MAIN COLOR or COLOR SCHEME? (circle one) 26

RED or SHADES OF RED 1
GREEN or SHADES OF GREEN 2
BLUE or SHADES OF BLUE 3
BROWN or SHADES OF BROWN 4
YELLOW or SHADES OF YELLOW 5
ORANGE or SHADES OF ORANGE 6
OTHER (specify) .....

168. Would you prefer your color scheme: 27

Brightly colored rooms 1
Subdued colored rooms 2
Neutral colored rooms 3
Two colors in one room 4
One major color with accents 5

169. There could be a number of decor items displayed in the halls. If you had your choice, what would you like to see displayed in hallways. 28 29

_____Representational paintings

_____Abstract modern paintings

_____Displays of your organization's work

_____Absolutely nothing on walls

_____Sculpture hung on walls

_____Areas for personal displays of employee's work

_____Areas for personal displays of employee's hobbies

_____Other _____

_____

BACKGROUND INFORMATION

170. Sex: ___Female ___Male 30 171. Branch or organizational symbol____ 31 33

172. Discipline (Professional)_____ 34 35

173. My room is ____ (If not assigned a specific room then indicate where most work is done____). 36 38

174. How many years of education after high school have you completed?_____ 39 40

175. Check the highest degree obtained. 41

1. Not a high school graduate
2. High school diploma
3. Junior College degree
4. Bachelor's degree
5. Master's degree
6. Doctorate
7. Post-Doctoral work

176. Do you have a professional certification? 1. Yes 2. No 42

177. How many years have you worked here? _____Yrs. 43 44

178. What is your present pay grade? _____ 45 46

179. Is your appointment: 1. Permanent 2. Temporary 47

180. To the best of your ability, indicate the <u>percentage of time</u> you spend in each of the following activities during an average day. The total should equal 100% (select only those activities that apply).

_____Writing	48 49	_____Thinking	62 63
_____Reading	50 51	_____Drawings	64 65
_____Talking	52 53	_____Painting	66 67
_____Layout	54 55	_____Typing	68 69
_____Filing	56 57	_____Sorting	70 71
_____Collating	58 59	_____Mailing	72 73
_____Other	60 61	100% TOTAL	

181. If you have any suggestions for improving offices or if you wish to comment on anything not covered in the questionnaire, please do so below. (Do so below or on reverse side).

2

SECTION II: EQUIPMENT AND ACTIVITY INVENTORY

The purpose of this questionnaire is to document your job related activities and equipment so that we can best specify furniture and equipment for your work area. Please read the instructions before beginning the questionnaire.

Please circle the appropriate items.

1. During an "average" work day how many trips will you personally make to a copy machine? 74

   a. None
   b. 1-3
   c. 4-6
   d. 7-9
   e. 10 or more

2. During an "average work week" how many conferences or meetings will you participate in? 75

   a. None
   b. 1-3
   c. 4-6
   d. 7-10
   e. More than 10

3. Where are your conferences most frequently held? 76

   a. At your own workspace or office
   b. In a private conference room
   c. At someone else's workspace

4. Not including yourself, how many other persons will usually participate in these conferences? 77

   a. One other person
   b. 2-3 other people
   c. 4-5 other people
   d. More than 5 people

5. What is the typical duration of these conferences? 78

   a. 1-10 minutes
   b. 10-30 minutes
   c. 30 minutes to 1 hour
   d. Over 1 hour

6. Does your job require you to operate a typewriter? 79 80 3

   Yes Dup 1 3
   No

   Note: If you answered No on question 8, please skip to question 11, thank you.

7. Do you share use of a typewriter with one of your co-workers? 4

Yes
No

8. During an "average" work day how many hours do you spend operating a typewriter? 5

a. Less than 1 hour
b. 1-2 hours
c. 2-3 hours
d. 3-5 hours
e. over 5 hours

9. Does your job require you to work with computer print outs? 6

Yes
No

10. Are any of the files which you maintain or use, located in a central or department file area where more than one person retrieves information from them? 7

Yes
No

11. How often do you have visitors from outside this organization? 8

a. Never
b. Once or twice a month
c. Once or twice a week
d. Once or twice a day
e. More than twice a day

12. During an "average" work day how much time do you spend sitting at your desk/work station? 9

a. Less than 1 hour
b. 1-2 hours
c. 2-3 hours
d. 3-4 hours
e. More than 4 hours

13. Which of the following items do you have on your desk? Check as many items as appropriate.

a.	Telephone	10
b.	Dictaphone	11
c.	Light	12
d.	Stapler	13
e.	Intercom	14
f.	Address/directory	15
g.	Tape dispenser	16
h.	Personal items (like photographs, plants)	17
i.	Calculator	18
j.	Drafting equipment	19
k.	Office machine (typewriter, etc.)	20
l.	In/Out Basket	21
m.	Paper punch	22
n.	Blotter	23
o.	Box of tissues	24
p.	Ash tray	25
q.	Desk calendar	26

14. How many of your desk drawers are filled with "working files", i.e. information which is referred to periodically throughout the day? 27

a. 1/2 drawer or less
b. 1 drawer
c. 2 drawers
d. More than 2 drawers

15. Are any of the files you maintain contained within standard filing cabinets? 28

Yes
No

16. How many of these standard file drawers (approximately 24" deep) are filled with "working files", i.e. information which is referred to periodically throughout the day? 29

a. None
b. 1/2 drawer
c. 1 drawer
d. 2 drawers
e. 3 drawers
f. 4 drawers
g. More than 4 drawers

17. How many of these standard file drawers are filled with "dead" files; i.e. information which must be kept but which is seldom retrieved? 30

a. None
b. 1-2 drawers
c. 3-6 drawers
d. 7-10 drawers
e. 11-16 drawers
f. More than 16 drawers

18. How adequate is the amount of filing space you currently use? 31

a. Very inadequate
b. Somewhat inadequate
c. Slightly inadequate
d. Barely adequate
e. Somewhat adequate
f. Very adequate

19. How many books, notebooks, folders, binders, etc., less than 1" thick do you currently store in your work space (office)? 32

a. None
b. 1-25
c. 26-50
d. 51-75
e. 76-100
f. over 100

20. How many catalogs, manuals, binders, notebooks, etc. from 1-3" thick do you currently store in your workspace (office)? 33

a. None
b. 1-12
c. 13-24
d. 25-36
e. 37-48
f. over 48

21. How many catalogs, binders, manuals, books, etc. over 3" thick do you currently store in your workspace (office)? 34

a. None
b. 1-4
c. 5-8
d. 9-16
e. 17-24
f. 25 or over

22. Do you store extra amounts of stationary, envelopes, business forms, slides, miscellaneous office supplies and other items which are not used on a daily basis? 35

Yes
No

23. Do you usually have large graphic materials on display such as: flow charts, bar charts, maps, posters, plans, etc.? 36

a. Never
b. Almost never
c. Infrequently
d. Sometimes
e. Frequently
f. Almost always

24. Would a chalkboard be of use in completing your daily job tasks? 37

a. Unnecessary
b. No particular feeling
c. Somewhat useful
d. Useful
e. Very useful

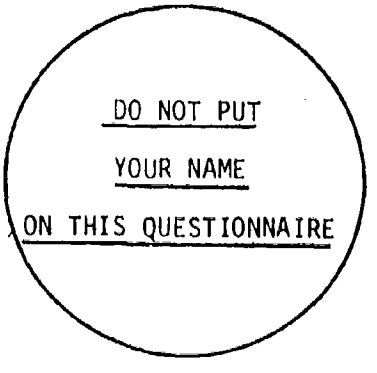
SECTION III: WORK ENVIRONMENT

The following questionnaire is designed to measure the ways you perceive and react to various aspects of your work environment. This information will be used to determine the effects of different conditions upon people who work in them. Recommendations will then be made regarding changes and improvements in the work area.

The questionnaire will require about 15 minutes of your time. This amount of time is necessary for us to obtain a more real picture of the conditions which presently exist so that we might make more meaningful suggestions for change.

Please read each question carefully and answer it thoughtfully. The information you provide is CONFIDENTIAL AND FOR RESEARCH PURPOSES ONLY. NO INFORMATION REGARDING INDIVIDUAL RESPONSES WILL BE DIVULGED.

Thank you for your help.



(In this section, branch is used to define your organizational element. Organization refers to the laboratory as a whole)

1. How often is the amount of light, heat, or air in your work areas so bad that it bothers you? 38

   a. Almost always
   b. Usually
   c. Sometimes
   e. Seldom
   f. Almost never

2. How often do you feel unable to satisfy the conflicting demands of various people over you? 39

   a. Never
   b. Rarely
   c. Sometimes
   d. Often
   e. Almost always

3. Opportunities for independent thought and action on my job are: 40

   a. Non-existent
   b. Limited
   c. Fairly good
   d. Quite good
   e. Outstanding

4. How often do you have opportunities to work on different jobs? 41

   a. Never
   b. Rarely
   c. Sometimes
   d. Often
   e. Nearly all the time

5. How many tasks do you perform on your job which you consider relatively unimportant or unnecessary? 42

   a. Nearly all
   b. Quite a number
   c. A few
   d. Very few
   e. Practically none

6. I usually have good information on where I stand and how my performance is evaluated. 43

   a. Strongly agree
   b. Agree
   c. Not sure
   d. Disagree

7. How often do you work on difficult and challenging problems in your job? 44

a. Never
b. Rarely
c. Sometimes
d. Rather often
e. Nearly all the time

8. The condition of the equipment and supplies used in my work is: 45

a. Poor
b. Unsatisfactory
c. Fair
d. Good
e. Excellent

9. To what extent are you required to follow a specified set of rules and procedures in doing your job? 46

a. To a very great extent; I must follow rules and procedures exactly
b. To a great extent; changes can very rarely be made
c. To a moderate extent; changes can be made on some things but often I must follow set rules and procedures
d. To a limited extent; there are only a few rules and procedures for my job
e. Not at all; there are no specified rules and procedures for my job

10. Procedures are designed so that equipment is used efficiently 47

a. Strongly agree
b. Agree
c. Not sure
d. Disagree
e. Strongly disagree

11. To what extent are you required to meet rigid standards of quality in your work? 48

a. To a very great extent
b. To a great extent
c. To some extent
d. To a small extent
e. Not at all

12. To what extent is dealing with other people a part of your job? 49

a. Very little; working with other people is not an important part of my job
b. Somewhat; I have to deal with some other people, but this is not a major part of my job
c. Frequently; I deal with many other people as a part of my job
d. Very much; probably the single most important part of my job is working with other people

13. How well does your supervisor recognize and reward good performance by his people? 50

a. He is not a good supervisor in this respect
b. He recognizes good work but does little in the way of rewarding
c. He recognizes and rewards good work
d. He is very appreciative and eager to reward good work

14. To what extent does your supervisor emphasize high standards of performance? 51

a. Not at all
b. To a small extent
c. To some extent
d. To a great extent
e. To a very great extent

15. To what extent does your supervisor show you how to improve your performance? 52

a. Not at all
b. To a small extent
c. To some extent
d. To a great extent
e. To a very great extent

16. To what extent does your supervisor encourage the people who work for him to work as a team? 53

a. Not at all
b. To a small extent
c. To some extent
d. To a great extent
e. To a very great extent

17. Overall, how good a job do you feel is being done by your immediate supervisor? 54

a. Very good
b. Good
c. Fair
d. Poor
e. Very poor

18. How successful is your immediate supervisor in dealing with higher levels of command? 55

a. Outstandingly successful
b. Very successful
c. Definitely above average success
d. About average success
e. Below average success

19. The people here generally trust their branch heads. 56

a. Strongly agree
b. Agree
c. Not sure
d. Disagree
e. Strongly disagree

20. Everything is checked; individual judgment is not trusted 57

a. Strongly agree
b. Agree
c. Not sure
d. Disagree
e. Strongly disagree

21. The work space and furniture in our work group is: 58

a. Excellent
b. Good
c. Passable
d. Somewhat unsatisfactory
e. Poor

22. How does your branch compare to all other branches in the division in terms of productivity? 59

a. Is one of the most productive branches (top 5%)
b. Is considerably above average in productivity (top 20%)
c. Is somewhat above average in productivity (top 40%)
d. My branch has about average productivity for the district
e. Is somewhat below average in productivity

23. Most members of my Branch take pride in their jobs. 60

a. Strongly agree
b. Agree
c. Not sure
d. Disagree
e. Strongly disagree

24. To what extent does a friendly atmosphere prevail among most of the members of your Branch? 61

a. To a very small extent
b. To a small extent
c. To some extent
d. To a considerable extent

25. People are encouraged to ask questions about the Branch's affairs. 62

a. Strongly agree
b. Agree
c. Not sure
d. Disagre
e. Strongly disagree

26. In this organization about the only source of information on important matters is the grapevine (rumor). 63

a. Strongly agree
b. Agree
c. Not sure
d. Disagree
e. Strongly disagree

27. Generally there are friendly and cooperative relationships between the different branches in this organization. 64

a. Strongly agree
b. Agree
c. Not sure
d. Disagree
e. Strongly disagree

28. In this organization things seem to happen contrary to rules and regulations 65

a. Strongly agree
b. Agree
c. Not sure
d. Disagree
e. Strongly disagree

29. How clearly defined are the objectives of your Branch? 66

a. Sometimes obscure or poorly defined
b. Generally adequately defined
c. Better than most
d. Exceptionally well defined

30. How consistently are organization's policies applied to all? 67

a. Totally inconsistent
b. Inconsistent most of the time
c. Consistent most of the time
d. Completely consistent, all are treated the same

31. Working conditions in this Branch are better than in other Branches. 68

a. Strongly agree
b. Agree
c. Not sure
d. Disagree
e. Surely disagree

32. On the basis of your experience and information, how would you rate your Branch on effectiveness? 69

a. Very poor
b. Poor
c. Fair
d. Good
e. Very good

33. The cleanliness and up-keep of the rest rooms and other facilities we use is: 70

a. Very poor
b. Poor
c. Passable
d. Good
e. Very good

34. To what extent does your Branch emphasize personal growth and development? 71

a. Not at all
b. To a very small extent
c. To a small extent
d. To some extent
e. To a considerable extent

35. Superiors keep well-informed about the needs and problems of the people working here 72

a. Strongly agree
b. Agree
c. Not sure
d. Disagree
e. Strongly agree

36. How do you feel about recommending this organization to a prospective employee? 73

a. I would not recommend it under any circumstances
b. I would probably recommend it under certain circumstances
c. I would recommend it to most employees

37. Considering everything, how satisfied are you with your present job? 74

a. Very dissatisfied
b. Dissatisfied
c. Indifferent
d. Satisfied
e. Very satisfied

38. How often do you wish you could quite your present job? 75

a. About all the time
b. Very often
c. Somewhat often
d. Seldom
e. Never

39. Generally speaking, how satisfied are you with the kind of work you have to do on your job? 76

a. Very dissatisfied
b. Dissatisfied
c. Indifferent
d. Satisfied
e. Very satisfied

40. Considering everything, how would you rate your overall satisfaction in this branch at the present time? 77

a. Very dissatisfied
b. Dissatisfied
c. Indifferent
d. Satisfied
e. Very satisfied

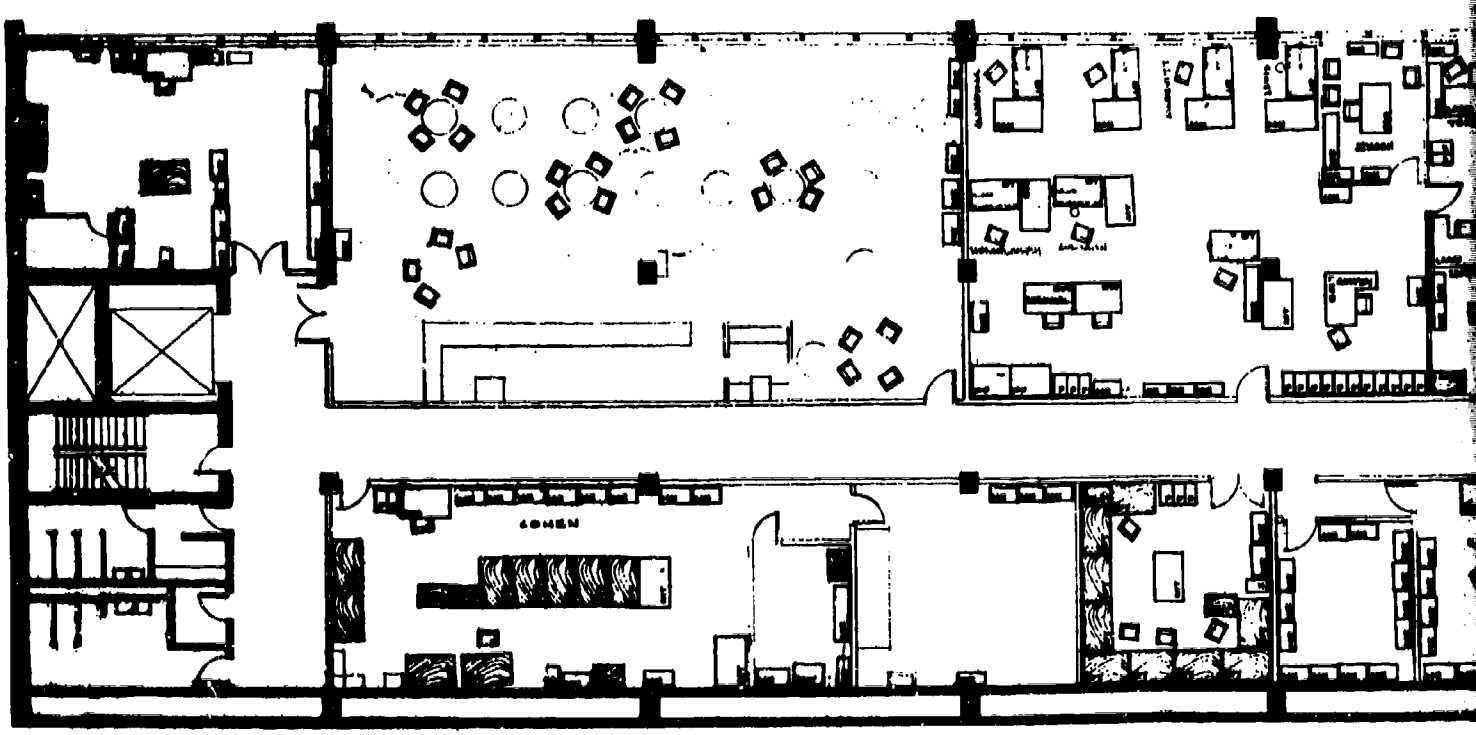
41. Are you: 78

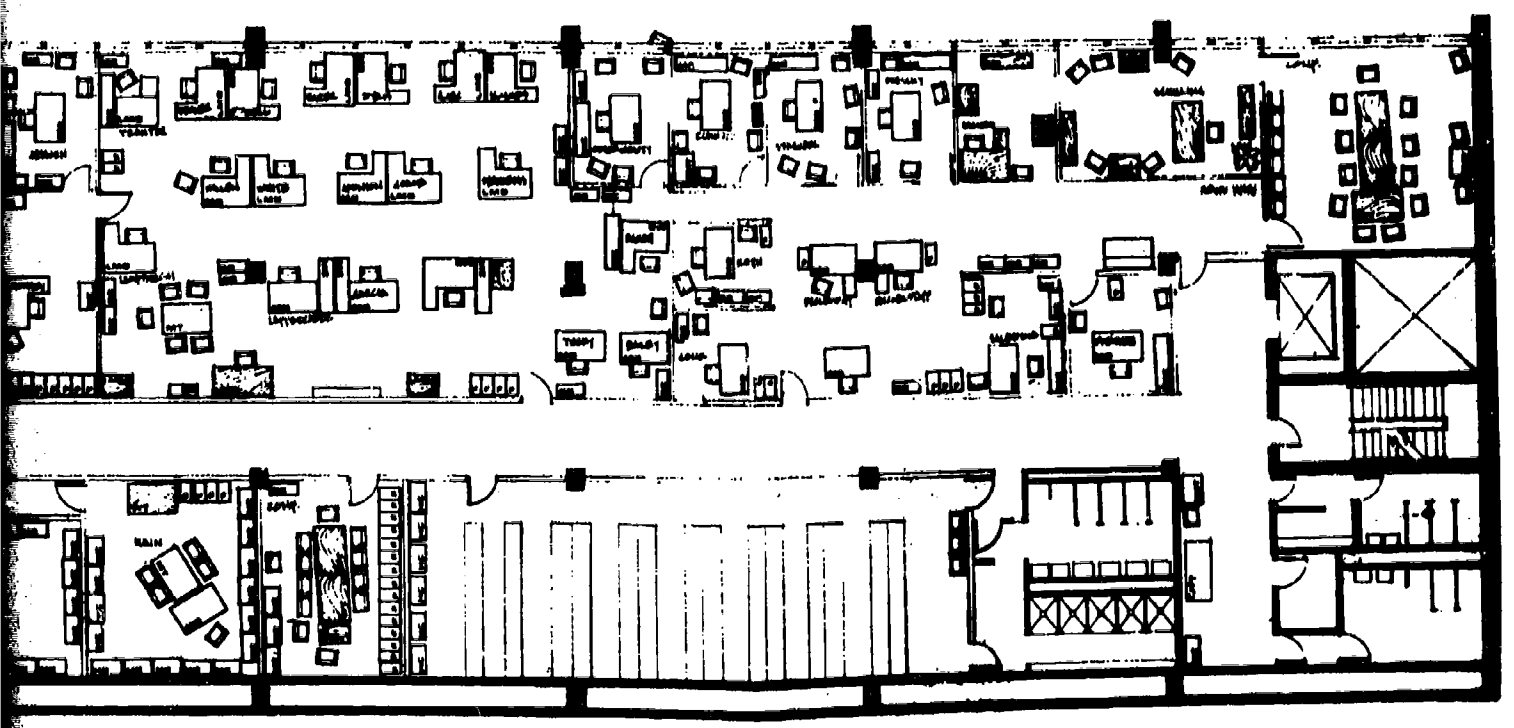
a. Administrative/support
b. Professional/technical

42. Are your responsibilities classified as: 79

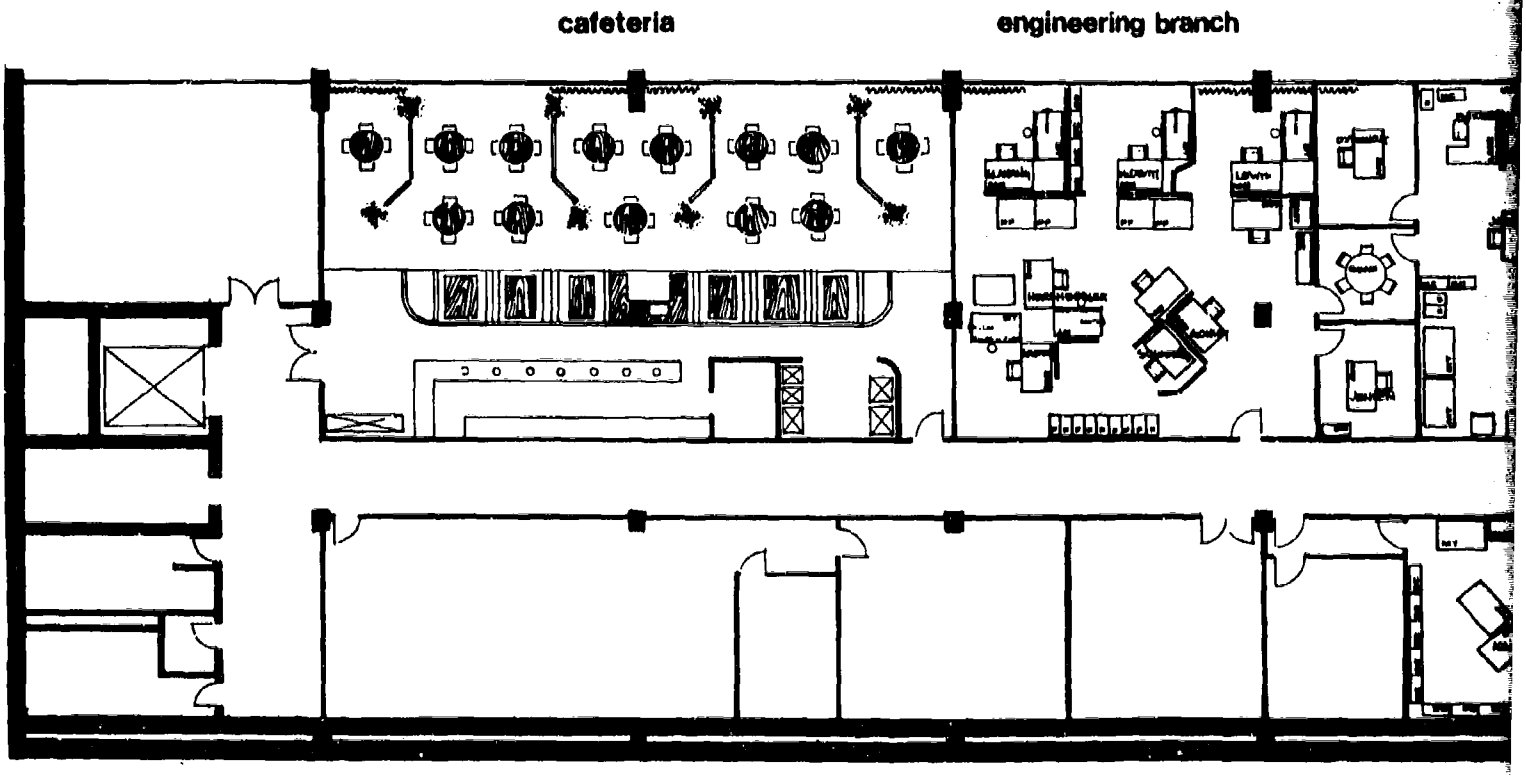
a. Supervisory and management 80 4
b. Principal investigator or equivalent
c. Other than above

APPENDIX B:
PLANS OF THE OFFICE AREA BEFORE AND AFTER RENOVATION


COHEN



second floor
faa - nafec
existing condition

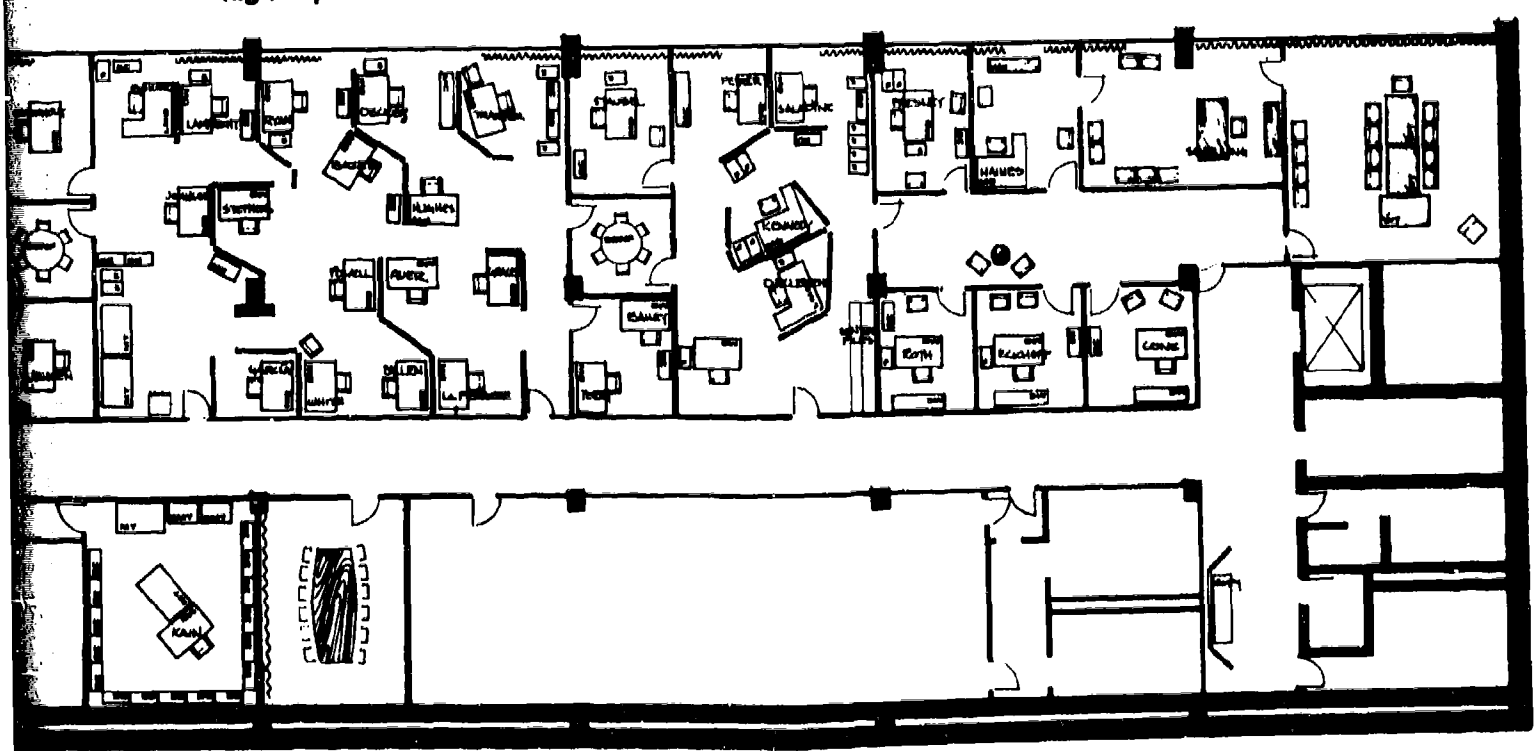

cafeteria
engineering branch
technic

flight operations

admin support

admin exec

conference



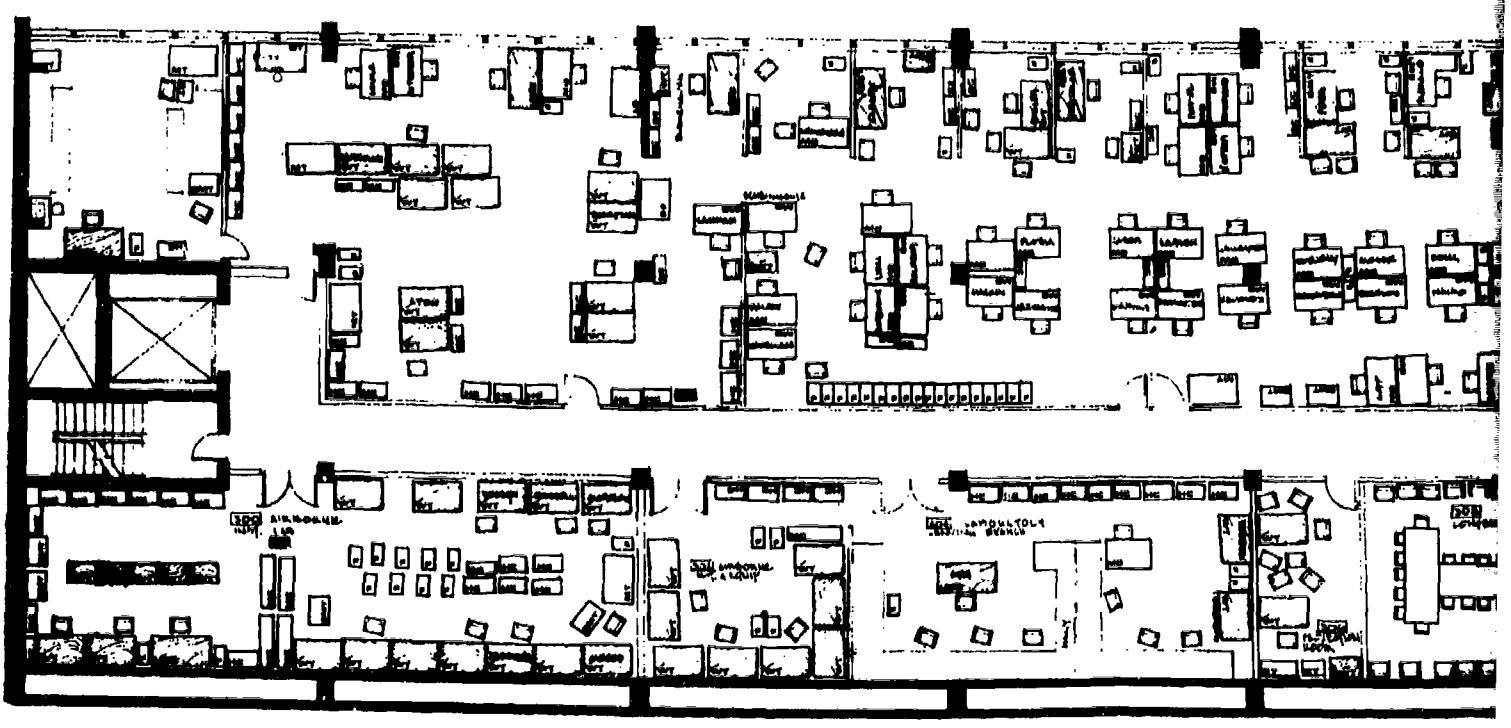
technical lib

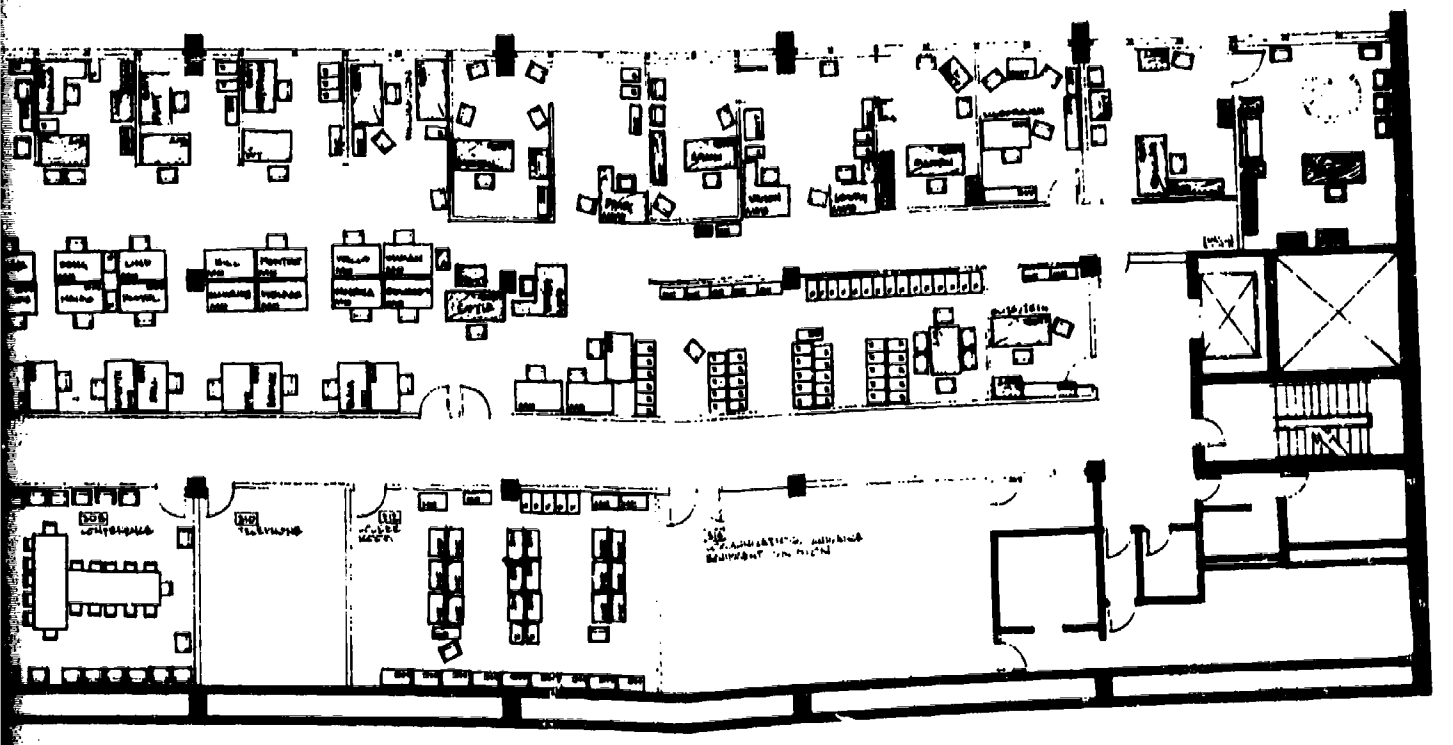
conference

second floor

faa - nafec

as built

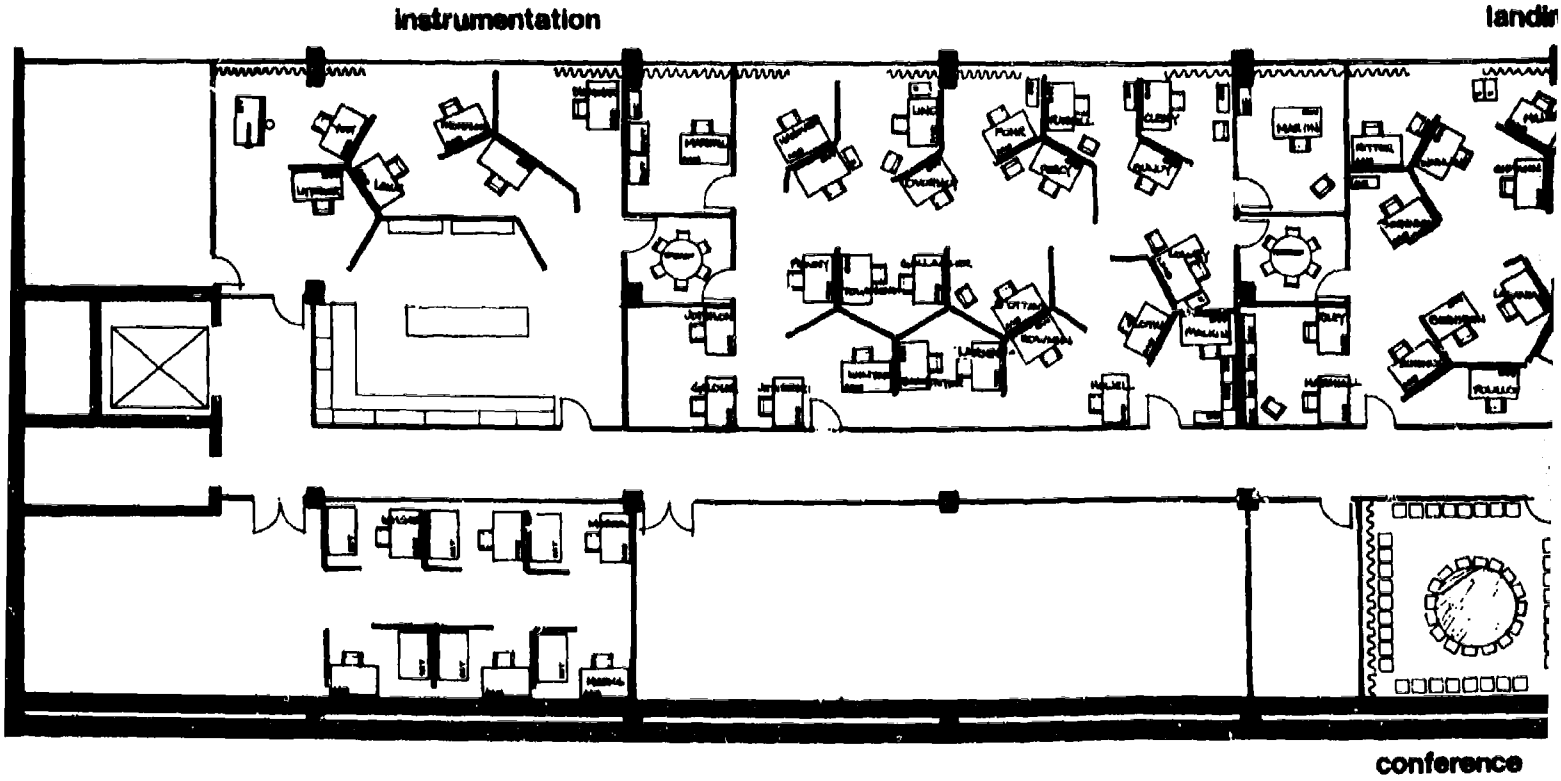


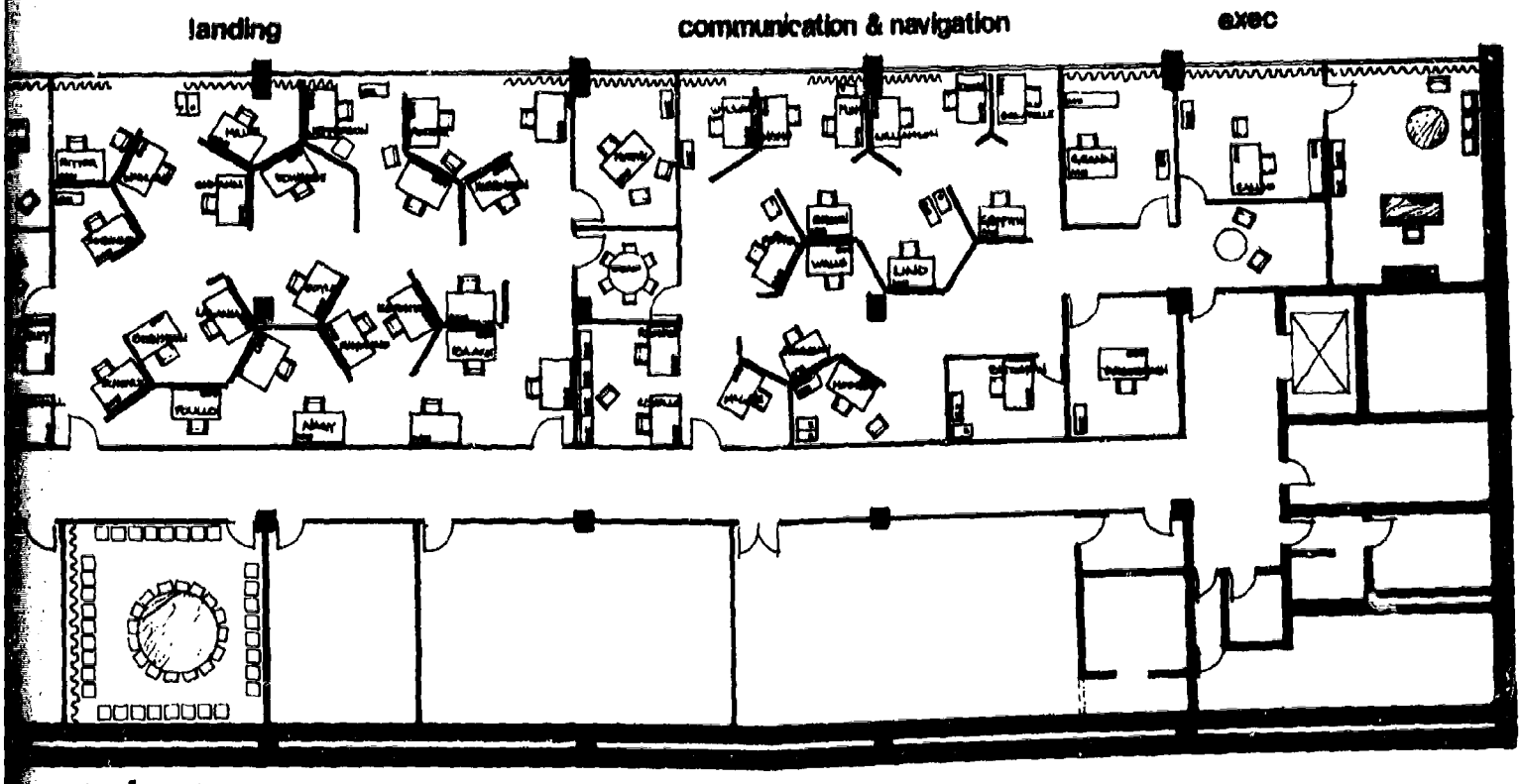


third floor

faa-nafec

existing condition


instrumentation
landi
conference



third floor
faa - nafec
as built

APPENDIX C:
NAFEC AFTER-RENOVATION EVALUATION SUMMARY

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

DATE:

IN REPLY REFER TO:

NATIONAL AVIATION FACILITIES
EXPERIMENTAL CENTER
ATLANTIC CITY, NEW JERSEY 08405

SUBJECT: Building 301 modifications

FROM: Chief, Management Systems Division, ANA-60

TO: ANA-1C

This letter is to advise you of our findings regarding the physical modifications of the interior of the building 301 offices. The findings are an offshoot of the ongoing space utilization study conducted by the U. S. Army Corps of Engineers (CERL). The following comments are based on a questionnaire circulated by ANA-60, personal observations, and personal interviews. The questionnaire was administered prior to and following the physical changes in the building. The interviews were conducted within the past thirty days.

Interviews with employees and managers in the building yielded the following information:

1. The lowered accoustical ceilings were an improvement. They provided for a quieter, brighter, better looking environment. Noise from the air conditioning and heating units was eliminated, but conversational noise increased. Music was used to decrease the noise.

2. The ceiling and desk lighting was inadequate for desk work. Glare from desk lamps necessitated installation of light reflectors.

3. Lower rather than higher partitions were preferred in ANA-300 because the latter cut off more light, created a closed-in feeling, and hindered locating employees who received phone calls. Neither provided adequate sound absorption. Higher partitions were preferred in ANA-600 due to the privacy factor.

4. Storage space was thought to be inadequate. Visual location of employees is difficult.

5. The new furniture is of poor quality. (i.e., numerous instances of chipped paint.) Desk drawers stick and locks break easily. Employees preferred the old repainted furniture.

6. The centralized electric filing and storage system is located too far from the work stations for immediate access.

7. The mini-conference rooms are seldom used because they are too small, noisy, and provide little privacy. They were converted to pilot scheduling room in ANA-640.

8. The carpeting is less tiring to walk on and doesn't show the dirt. However, sections don't match, seams are ripped, the padding is too thick, and large areas already show much wear.

9. The draperies are viewed as useless because they are seldom closed and then only to reduce the drafts. Prefer drapes that open in the middle.

10. The overall color scheme is satisfactory, however, most employees preferred washable walls and pastel colors.

11. The cafeteria is used more often now. Booths are preferred to the tables and chairs (too wobbly) but the booth tables should be movable. The partitions take up too much floor space. The carpet shows the dirt and most chairs are broken already.

12. The branch offices provide no sound privacy because the walls aren't ceiling-high.

13. There is inadequate seating (one chair) in the reception area.

14. The coat racks are too short, of poor quality, and the bottom area is seldom used. Also, their location results in poor use of wall space, especially in the reception area.

Based on the foregoing comments, the following recommendations should be considered when designing the new buildings:

1. Install low accoustical ceilings and pipe background music through the office areas. Speaker placement is important.

2. Augment ceiling lighting with individual, adjustable desk lamps.

3. Enclose work stations using the higher partitions and install a local intercom system on branch chiefs' and secretaries' telephones.

4. Use washable, pastel paints on walls.

5. Investigate alternate arrangement of work stations, and provide additional storage units at work stations.

6. Procure more durable furniture.

7. Procure smaller units of the electric filing and storage system and locate in branch areas, where applicable.

8. Use floor-to-ceiling walls to totally-enclose the mini-conference rooms, enlarge to hold up to 15 employees, and locate as far away from work stations as possible.

9. Procure better quality carpeting and use thinner padding.

10. Obtain more functional draperies.

11. Only install booths in the cafeteria, use fewer partitions, and procure movable booth tables.

12. Use floor-to-ceiling walls to totally enclose the branch chiefs' offices.

13. Provide additional seating in the reception areas to accommodate approximately five visitors.

14. Procure more functional coat racks and locate so as to make better use of wall space.

The statistical data obtained in the questionnaires will be relayed to CERL. The following information has been gleaned from it and is forwarded for your information.

The results of the ANA-300 questionnaires are incomplete at this time because approximately one-third of the employees are on official travel. Tabulations of the before and after questionnaires submitted by ANA-600 employees is shown in Attachments 2 and 3. In general, there was a statistically significant decrease in the number of trips made away from the work station (48%), the distance travelled (57%), and the number of distractions encountered while at the work station (53%). These findings lead to the conclusion that after the renovations were completed less time was spent in non-productive activity; therefore, more time was available for productive activity. In addition, the following observations are of particular note:

1. There was a 31% decrease in the number of personal trips made away from the work station and a 46% decrease in the distance travelled.

2. There was a 53% decrease in the number of business trips made away from the work station and a 60% decrease in the distance travelled.

3. There was a 53% decrease in the number of distractions encountered while at the work station.

4. There was a 56% decrease in all categories of distractions except noise from office equipment and noise generated from hallways. These two categories showed a 43% increase in the number of distractions encountered.

5. There was a 12% decrease in the number of trips made to the cafeteria for lunch and coffee breaks.

6. All constant distractions were eliminated except noise from office equipment.

7. There was an 80% decrease in the distance travelled for work-related conversations.

DONALD M. JOHNSON

Enclosures

CERL DISTRIBUTION

Picatinny Arsenal
ATTN: SMUPA-VP3

Director of Facilities Engineering
APO New York 09827
APO Seattle, WA 98749

Chief of Engineers
ATTN: DAEN-ASI-L (2)
ATTN: DAEN-MPO-B
ATTN: DAEN-MPZ-A
ATTN: DAEN-MPR
ATTN: DAEN-RDL

National Defense Headquarters
Director General of Construction
Ottawa, Ontario K1AOK2
Canada

Division of Building Research
National Research Council
Montreal Road
Ottawa, Ontario K1AOR6
Canada

Airports and Const Services Dir
Technical Information Reference Centre
KAOL, Transport Canada Building
Place de Ville
Ottawa, Ontario K1AON8
Canada

British Liaison Officer (5)
U.S. Army Mobility Equipment Research and Development Center
Ft Belvoir, VA 22060

Ft Belvoir, VA 22060
ATTN: ATSE-TD-TL (2)
ATTN: MAJ Shurb (4)
ATTN: FESA

Ft Leavenworth, KS 66027
ATZLCA-SA/F. Wolcott

HQ, US Army Garrison, Honshu
ATTN: DFE

AFE, Camp Humphreys
APO San Francisco 96271

Ft Monroe, VA 23651
ATTN: ATEN-AD (3)
ATTN: ATEN-FE-BG

Ft McPherson, GA 30330
ATTN: AFEN-FED

6th US Army
ATTN: AFKC-EN

USA-WES
ATTN: Concrete Laboratory
ATTN: Library

USA-CRREL

US Army Engineer District
Saudi Arabia
ATTN: Library
New York
ATTN: Chief, Design Br
Pittsburgh
ATTN: Library
ATTN: Chief, Engr Div
Philadelphia
ATTN: Library
ATTN: Chief, NAPEN-D
Baltimore
ATTN: Library
ATTN: Chief, Engr Div
Norfolk
ATTN: Library
ATTN: Chief, NAOEN-D
Huntington
ATTN: Chief, ORHED-D
ATTN: Library
Charleston
ATTN: Chief, Engr Div

US Army Engineer District
Savannah
ATTN: Library
ATTN: Chief, SASAS-L
Jacksonville
ATTN: Library
ATTN: Const. Div
ATTN: Env. Res. Br.
Mobile
ATTN: Library
ATTN: Chief, SAMEN-D
Nashville
ATTN: Library
ATTN: Chief, ORNED-D
Memphis
ATTN: Library
Vicksburg
ATTN: Chief, Engr Div
Louisville
ATTN: Chief, Engr Div
Detroit
ATTN: Library
ATTN: Chief, NCEED-T
St. Paul
ATTN: Chief, ED-D
Chicago
ATTN: Chief, NCCVE
St. Louis
ATTN: Library
ATTN: Chief, ED-D
Kansas City
ATTN: Library (2)
ATTN: Chief, Engr Div
Omaha
ATTN: Chief, Engr Div
New Orleans
ATTN: Library (2)
ATTN: Chief, LMNED-DG
Little Rock
ATTN: Chief, Engr Div
Tulsa
ATTN: Chief, Engr Div
ATTN: Library
Fort Worth
ATTN: Chief, SWFED-D
Galveston
ATTN: Chief, SWGAS-L
ATTN: Chief, SWGED-DS
Albuquerque
ATTN: Library
ATTN: Chief, Engr Div
Los Angeles
ATTN: Library
ATTN: Chief, SPLED-D
San Francisco
ATTN: Chief, Engr Div
Sacramento
ATTN: Chief, SPKED-D
ATTN: Library, Room 8307
Far East
ATTN: Chief, Engr Div
Japan
ATTN: Library
Portland
ATTN: Library
ATTN: Chief, DB-6
Seattle
ATTN: Chief, EN-DB-ST
ATTN: Chief, NPSEN-PL-ER
Walla Walla
ATTN: Library
ATTN: Chief, Engr Div
Alaska
ATTN: Library
ATTN: NPASA-R

US Army Engineer Division
Europe
ATTN: Technical Library
New England
ATTN: Library
ATTN: Laboratory
ATTN: Chief, NEDED-T
North Atlantic
ATTN: Library
ATTN: Chief, NADEN-T
Middle East (Rear)
ATTN: MEDED-T

US Army Engineer Division
South Atlantic
ATTN: Chief, SADEN-TA
ATTN: Library
Huntsville
ATTN: Library (2)
ATTN: Chief, HNDED-CS
Lower Mississippi Valley
ATTN: Library
Ohio River
ATTN: Library
ATTN: Chief, Engr Div
North Central
ATTN: Library
ATTN: Chief, Engr Div
Missouri River
ATTN: Library (2)
ATTN: Chief, MRDED-T
Southwestern
ATTN: Library
ATTN: Chief, SWDED-TA
South Pacific
ATTN: Chief, SPDED-TG
Pacific Ocean
ATTN: Chief, Engr Div
ATTN: Chief, PODED-D
North Pacific
ATTN: Chief, Engr Div

Facilities Engineer
FORSCOM
Ft Campbell, KY 42223
Ft Hood, TX 76544
Ft Devens, MA 01433
Ft Carson, CO 80913
Ft Lewis, WA 98433
Ft Riley, KS 66442
Ft Polk, LA 71459
Ft Ord, CA 93941
Ft Stewart, GA 31313
TRADOC
Ft Dix, NJ 08640
Ft Monroe, VA 23651
Ft Lee, VA 23801
Ft Gordon, GA 30905
Ft McClellan, AL 36201
Ft Knox, KY 40121
Ft Sill, OK 73503
Ft Bliss, TX 79916
DSCPER
West Point, NY 10996
USAIC
Ft Benning, GA 31905
USAAVNC
Ft Rucker, AL 36361
CAC&FL
Ft Leavenworth, KS 66027
AMC
Dugway, UT 84022
USACC
Ft Huachuca, AZ 85613

AFESC/PRT
Tyndall AFB, FL 32403

Naval Facilities Engr Command
ATTN: Code 04
Alexandria, VA 22332

Port Hueneme, CA 93043
ATTN: Library (Code L08A)
ATTN: Morell Library

Washington, DC
ATTN: Building Research Advisory Board
ATTN: Transportation Research Board
ATTN: Library of Congress (2)
ATTN: Dept of Transportation Library
ATTN: US Govt Printing Office

Defense Documentation Center (12)

Engineering Societies Library
New York, NY 10017

LT David C. Hall
2853 APG/DE
McClellan AFB, CA 95652

NAFEC (10)
ATTN: Frank D. Munroe
Atlantic City, NJ 08405

Commander
HQ, XVIII Airborne Corps and
Ft Bragg
ATTN: AFZA-FE-EE
Ft Bragg, NC 28307

Commander
HQ, 7th Army Training Command
ATTN: AETTG-DEH (5)
APO New York 09114

Commander
HQ USAEREUR and 7th Army
ODCS/Engineer
ATTN: AEAEN-EH (4)
APO New York 09403

Commander
7th Army Combined Arms Training Center
ATTN: AETTM-HRD-EHD
APO New York 09407

Commander
US Army Engineer Div, Europe
ATTN: Technical Library (3)
APO New York 09757

Commander
V Corps
ATTN: AETVDEH
APO New York 09079

Commander
VII Corps
ATTN: AETSDEH
APO New York 09154

Commander
21st Support Command
ATTN: AEREH
APO New York 09325

Commander
US Army Berlin
ATTN: AEBA-EN
APO New York 09742

Commander
US Army Southern European Task Force
ATTN: AESE-ENG
APO New York 09168

Commander
US Army Installation Support Activity, Europe
ATTN: AEUES-RP
APO New York 09403

LT Neil B. Hall, CEC, USNR (Code 100)
814-6366
US Navy Public Works Center
Box 6, FPO San Francisco 96651

Lozar, Charles C
Developing habitability information for the design of office environments / by Charles C. Lozar, Robert L. Porter. -- Champaign, IL : Construction Engineering Research Laboratory ; Springfield, VA : available from NTIS , 1979.
153 p. ; 27 cm. (Technical report ; E-142)

1. Architecture -- psychological aspects. 2. Office layout. 3. U.S. National Aviation Facilities Experimental Center. I. Porter, Robert L. II. Title. III. Series: U.S. Army Construction Engineering Research Laboratory. Technical report ; E-142.